

Dynamic Series Actuator & Controller

Operating Manual



Intelligent Actuator, Inc.

This publication was written to assist you in better understanding this part of your IA system. If you require further assistance, please contact IA Technical Support. For Central and East Coast Time Zones, please call our Itasca, IL office at 1-800-944-0333 or FAX 630-467-9912. For Mountain and Pacific Time Zones, please call our Torrance, CA office at 1-800-736-1712 or FAX 310-891-0815; Monday thru Friday from 8:30AM to 5:00PM.



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Thank you very much for selecting the Intelligent Actuator, DS series actuator/controller system. The DS series is compact, easy to use and can control the actuator and peripheral devices with ease. Also, the SEL language used in the DS series makes it possible to perform high level control with simple programming. Please read through this manual carefully to gain an understanding of the proper method of operating and handling the DS controller and actuator.

Safety Precautions:

This product was developed as components for driving automated equipment and is designed not to produce greater torquing or speed than is necessary. However, strictly observe the following items to prevent any accidents from occurring.

1. As a rule, any handling or operating methods not described in this manual should be viewed as things that should not be attempted. Please contact the company if any portion of the contents of this manual are unclear.
2. Use only the products specified for wiring between the actuator and controller.
3. Stand clear of the operating range of the machine when it is in motion or is ready to operate. Surround the system with safety partitions if there is a possibility that people can enter the area where the machine is being used.
4. When assembling, adjusting, or performing maintenance on the machine, always disengage the power supply to the controller. During work, display a sign stating work in progress where it is readily visible. Also, keep the power cable close to the operator so that another person cannot inadvertently switch on the power.
5. When more than one person is working on the system, agree on signals beforehand to ensure everyone's safety before beginning work. In particular, when doing work involving axis movement, always call out for everyone's safety regardless of whether power is ON or OFF, or the axis is to be mechanically driven or manually moved.
6. When the user needs to lengthen the cables, check the wiring carefully to make sure it is correct before turning the power ON since miswiring can lead to misoperation.

Warranty Period and Scope:

1. This product is under warranty for a period of one year from the date it is shipped to the customer. If the product breaks down due to a manufacturing defect during this period, IAI will repair it at no cost.
2. The following are not covered under the warranty, even if the product is still under the warranty period.
 - a. Damage due to incorrect handling or use that does not adhere to the instructions in the user's manual.
 - b. When electrical or mechanical revisions have been performed on the product.
 - c. Part wear when traveling distance has exceeded 5,000 km.
 - d. Breakdown or damage caused by fire, earthquake or other natural disasters.
 - e. Any other breakdown or damage that is not recognized as the company's responsibility.

2. Setting Up

1. Precautions When Using the Emergency Stop

As a rule, emergency stops should only be applied from the I/O.

Do not turn the power (AC117V) ON/OFF to effect an emergency stop.

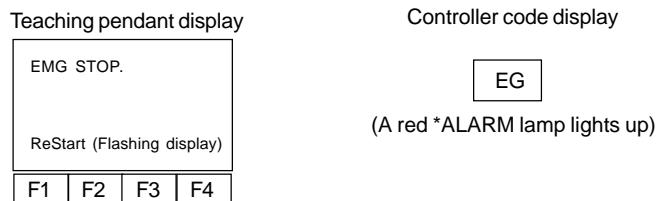
If you stop the actuator by turning the power OFF, wait at least 15 seconds before turning the power ON again. If you disregard this warning, and repeatedly turn the power ON/OFF without waiting a sufficient amount of time, you may damage the controller.

2. Restarting the Controller After an Emergency Stop (refer to part 3, 1-4 "Emergency Stop Release" for details)

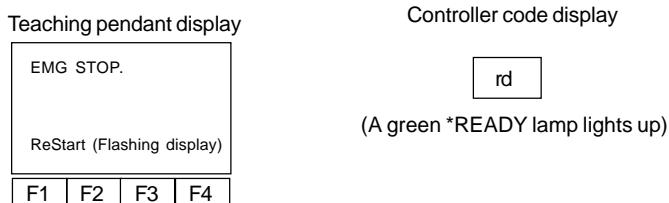
The Super SEL controller and Table Top type (TT-300) both use a "hard reset" to restart after an emergency stop. The operation is nearly the same as turning the power OFF/ON. (Homing is required).

(1) Emergency Stop from the teaching pendant

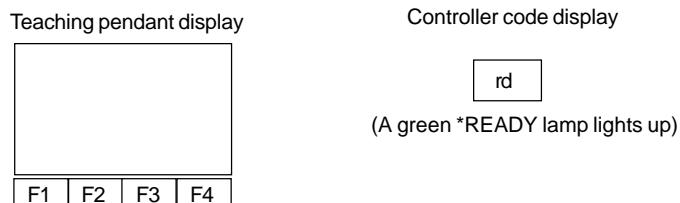
① Press EMERGENCY STOP on the teaching pendant. Continue pressing and the screen will display the following.



② Take your finger off the EMERGENCY STOP button to do a hard reset and the following screen appears.



③ If you press the **F1** key (ReStart) on the teaching pendant, the initial screen reappears.



(2) Pressing the controller emergency stop button or an emergency stop condition caused by an external signal

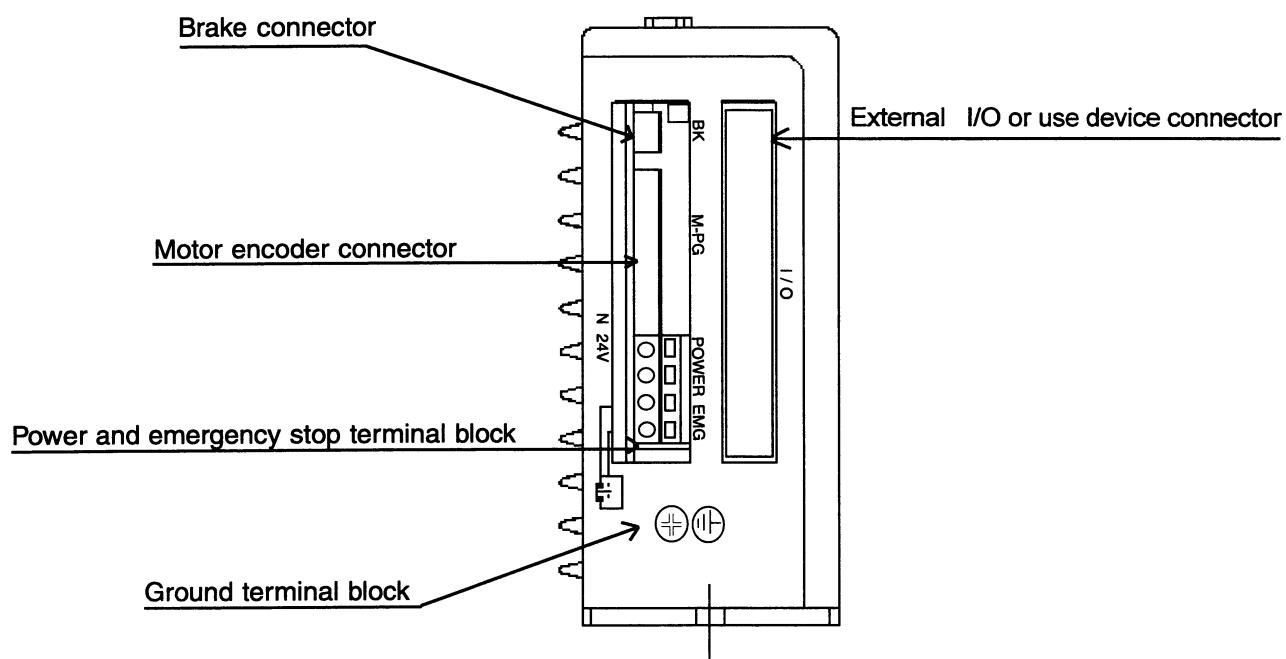
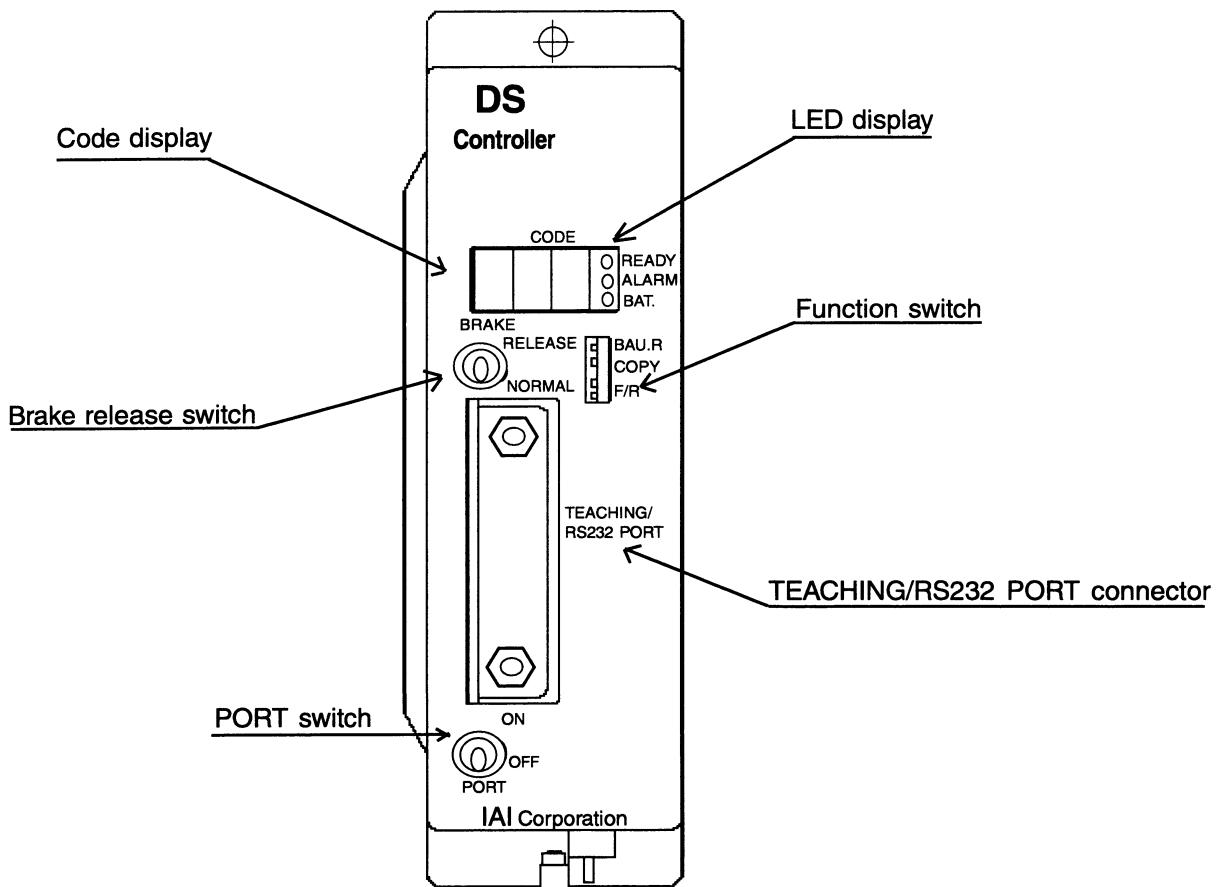
When the emergency stop is released after pressing the emergency stop button on the controller front panel, you must follow the same procedure as described above or the teaching pendant will not reset (you cannot operate the teaching box if the code display on the controller front panel reads **[EG]**).

! Warning

If you are using the Auto Start PRG in the system program parameter mode, always write the program so that movement will not resume unless there is some kind of input condition. This is to avoid sudden startup of movement because of the automatic start program right after the emergency stop is released.

3. Part Names and Functions

3.1 Part Names



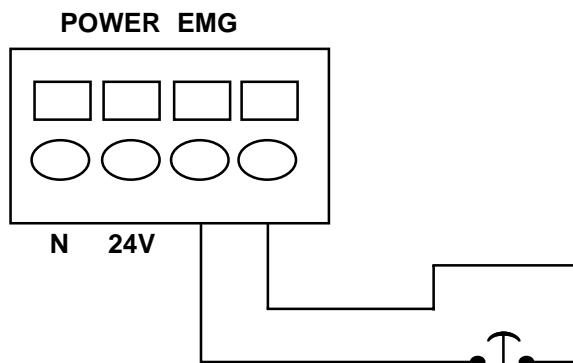
3. Part Names and Functions

3.2 Functions

CODE display	This is a 3-digit display device that indicates the operating status of the controller.	
LED display	READY	: This indicates that the controller is ready to be operated.
	ALARM	: This is the display when there is a malfunction in the equipment.
	BAT.	: This indicates battery voltage is low.
Brake release switch	RELEASE	: The brake is released.
	NORMAL	: The brake is ON. (This is the normal setting)
The brake release switch is enabled during the servo free state indicated below:		
	1.	From the time the power is turned ON until the homing command is given.
	2.	When [Svof] is selected during direct teaching.
	3.	When an alarm occurs.
PORt switch	ON	: The TEACHING/RS232PORT is enabled. However, when the TEACHING/RS232 PORT connector is not connected, an emergency stop occurs.
	OFF	: The TEACHING/RS232PORT is disengaged. However, even when the TEACHING/RS232PORT connector is not connected, the emergency stop is controlled by the external E-stop connection.
	Note:	When the controller is powered up, plug in or remove the TEACHING/RS232PORT connector when the PORT switch is OFF.
Function switch	BAU.R	: This is the switch for changing the Baud rate.
	COPY	: This is the switch for COPY from ROM to FLASH memory.
	F/R	: This is the switch for changing FLASH and ROM.
	Note:	At the time the unit is shipped, all switches are set to OFF so use them under normal circumstances.
TEACHING/RS232 PORT connector	This is a 25 pin RS232 connector for the teaching pendant or to a personal computer.	

3. Part Names and Functions

Brake connector	This is the actuator's brake connection.
Motor connector	This is the connector for connecting the actuator motor • encoder cable.
I/O device connector	This is a 34 pin I/O connector.
Ground terminal block	This is the M3 screw for the ground connection.
Power and emergency stop terminal block	This is the terminal for POWER N and 24V power. The two EMG terminals are for connecting the emergency stop switch. (When the unit is shipped, the EMG terminal is shorted.)



The user should meet the requirements and conditions given in the table below with respect to the power lines that are connected.

Suitable power line	Solid wire $\phi 1.2$ (AWG 16) Standard wire 1.25mm^2 (AWG 16)
Usable power line range	Solid wire $\phi 0.4$ (AWG26)~ $\phi 1.2$ (AWG 16) Standard wire 0.3mm^2 (AWG22)~ 1.25mm^2 (AWG 16) Standard diameter $\phi 0.18$ or greater
Standard line length	11mm
Suitable tool for button operation	Slot screwdriver (axis diameter $\phi 3$, width of tip 2.6)

Note: This controller does not have a power switch.

3. Part Names and Functions

3.3 Explanation of Code Display

	Open display
	Serial I/O check display
	Servo check display
	Program check display
	Ready display
	Flash memory copy display
	Flash memory copy complete display
	Update display
	Emergency stop display
	CPU reset
	Homing display
	Startup program No. display
	Position No. display (001~500)
	Interrupt error display
	Software error display
	Other error display

4. Specifications

4.1 Controller Specifications

Item	Description
Power Voltage	DC24V±10%
Power Current	24W Rated/1A (Maximum 48W)
Ambient Temperature & Humidity	Temperature: 0~40°C Humidity 85% RH or less
Operating Environment	Free of corrosive gas, no excessive dust
Isolation Resistance	500V 10MΩ or more
Unit Weight	560g
Safety Features	Driver alarm (Motor excess current: Excess voltage • Driver temperature check) Overload Check, software limit check
Motor	AC Servo Motor 20W
Control Functions	Multi-task Control Super SEL Controller
Memory Capacity	Total: 1000 steps, 500 positions
Memory Device	COMS RAM Battery Backup
Number of programs	32 programs, Multi-task function (maximum of 8 programs)
Input/Output (DC24V) Non-insulated	Dedicated inputs: 8 (PRG No. 1, 2, 4, 8 ,1, 20) Dedicated inputs: 1 (START) User inputs: 15 Dedicated outputs: 2 (Ready, ALARM) User outputs: 6
Data Input Method	Teaching Pendant or RS232 Communication
Communication	EIA RS232 Standard Asynchronous
Remote Update Functions	Software update (via network or floppy disk)

4. Specifications

4.2 External I/O Specifications

External Input Circuit

Item	Specification
External Power Voltage	DC 24V ± 10%
Input Current	7mA / DC24V
ON / OFF Voltage	ON voltage ... Main DC 18 OV OFF voltage ... Main DC 6 OV
Insulation	Non-insulated
Extent Connection Device	No-voltage contact point (minimum load about DC 5V • 1mA) Photoelectric • proximity sensor (NPN type) PLC Transistor output (open collector type) PLC Contact point output (minimum load about DC5V • 1mA)

Note: When a no-contact circuit is connected to an external circuit, make sure that the leakage current is under 1mA when the switch is OFF or, it could cause faulty operation.

External Output Circuit

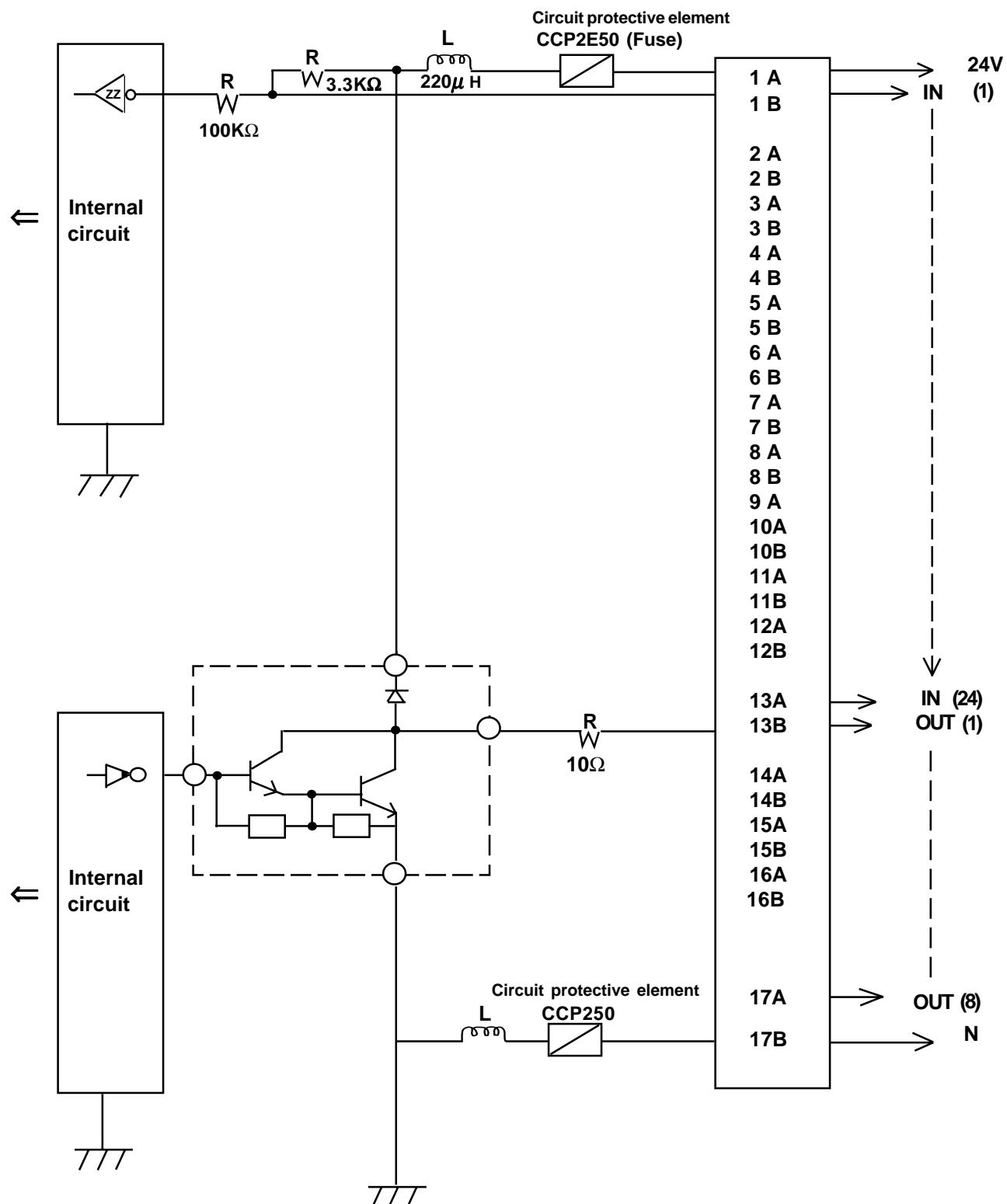
Item	Specification	
Load Voltage	DC 24V	
maximum Load Voltage	100mA / 1 point 400mA peak (all current)	Application for TD62084
Recommend Load Voltage	20mA / 1 point	
Leakage Current	Max 0.1mA	
Insulation External Connection Device	Non-insulated	
External Connection Device	Miniature relay Sequence input unit (sink type)	

Note 1: For all of the external outputs, the flyback diode (D) is connected on the inside.

Note 2: Take care when connecting because if the load short circuits or the current exceeds the maximum load current, this will cause a failure in the output circuit.

4. Specifications

External I/O Circuit



4. Specifications

4.3 Interface List

Specifications for I/O Interface during program mode and position mode are different.

The interface list for each is indicated in the following tables:

Position Mode
I/O Connector (34 Pin)

Pin No.	Section	Port No.	Function	Cable Color
1A	P24		External current + 24v in out	1-Brown
1B			NC	1-Red
2A			NC	1-Orange
2B			NC	1-Yellow
3A			NC	1-Green
3B			NC	1-Blue
4A			NC	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	Hold Input	2-Brown
6B		002	NC	2-Red
7A		003	NC	2-Orange
7B		004	Position No. 1 Input	2-Yellow
8A		005	Position No. 2 Input	2-Green
8B		006	Position No. 4 Input	2-Blue
9A		007	Position No. 8 Input	2-Purple
9B		008	Position No. 10 Input	2-Gray
10A		009	Position No. 20 Input	2-White
10B		010	Position No. 40 Input	2-Black
11A		011	Position No. 80 Input	3-Brown
11B		012	Position No. 100 Input	3-Red
12A		013	Position No. 200 Input	3-Orange
12B		014	Position No. 400 Input	3-Yellow
13A		015	NC	3-Green
13B	Output	300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	Positioning Complete Output	3-Gray
15A		303	NC	3-White
15B		304	NC	4-Black
16A		305	NC	4-Brown
16B		306	NC	4-Red
17A		307	NC	4-Orange
17B	N24		Emergency Current OV	4-Yellow

Caution:
External 24V power must be connected to I/O connector 1A pin and 17B. Make sure that the power is OFF during connection, and avoid short circuit and reverse connection.

Note:
PRG = Program
NC = No contact

- * Do not use number 1B (PRG No.1 input) through pin number 4A (PRG No.20) since these are for program number input.
- * Position mode can be used when program number input is "0" (OFF).
- * When using the controller in position mode, use pin number 7B (Port No.004) through pin number 12B(Port No. 014) for position number input.
- * Homing is performed when position number input is "0" (OFF) and start input is set to "1" (ON).
- * Please note that when the I/O connector (external 24V power) is not connected, the controller considers all input ports and program inputs to be "1" (ON). In this case, the controller changes to reset status.

4. Specifications

Program Mode I/O Connector (34 pin)

Pin No.	Section	Port No.	Function	Cable Color
1A	P24		External current + 24v in out	1-Brown
1B			PRG No. 1 Input	1-Red
2A			PRG No. 2 Input	1-Orange
2B			PRG No. 4 Input	1-Yellow
3A			PRG No. 8 Input	1-Green
3B			PRG No. 10 Input	1-Blue
4A			PRG No. 20 Input	1-Purple
4B			Reserve	1-Gray
5A			CPU Reset Input	1-White
5B		000	Start Input	1-Black
6A		001	User Input	2-Brown
6B		002	User Input	2-Red
7A		003	User Input	2-Orange
7B		004	User Input	2-Yellow
8A		005	User Input	2-Green
8B		006	User Input	2-Blue
9A		007	User Input	2-Purple
9B		008	User Input	2-Gray
10A		009	User Input	2-White
10B		010	User Input	2-Black
11A		011	User Input	3-Brown
11B		012	User Input	3-Red
12A		013	User Input	3-Orange
12B		014	User Input	3-Yellow
13A		015	User Input	3-Green
13B		300	Alarm Output	3-Blue
14A		301	Ready Output	3-Purple
14B		302	User Output	3-Gray
15A		303	User Output	3-White
15B		304	User Output	4-Black
16A		305	User Output	4-Brown
16B		306	User Output	4-Red
17A		307	User Output	4-Orange
17B	N24		Emergency Current OV	4-Yellow

Note: PRG = Program

- * Please use pin No. 1B (PRG No.1 input) through pin No. 4A (PRG No.20) for inputting program numbers.
- * Please note that when the I/O connector (external 24V power) is not connected, the controller considers all input ports and program inputs to be "1" (ON). In this case, the controller changes to reset status.

Caution:
External 24V power must be connected to I/O connector 1A pin and 17B. Make sure that the power is OFF during connection, and avoid short circuit and reverse connection.

4. Specifications

4.4 TEACHING/RS232PORT

D-Sub 25 DTE (Special x)

Pin No.	Signal Name	Pin No.	Signal Name
1	FG	14	NC
2	TXD	15	NC
3	RXD	16	NC
4	(RTS) Short Circuit (CTS)	17	NC
5		18	+ 6V Output *
6	DSR	19	ENABLE *
7	SG (GND)	20	DTR
8	NC	21	NC
9	NC	22	NC
10	NC	23	EMG-STOP *
11	NC	24	NC
12	EMG S2 *	25	GND *
13	EMG S1 *		

EMG SW →

← → ENABLE SW

PORT SW

Note: Controller will E-stop if Teaching/RS232 port SW is ON with nothing connected.

- * In the case of RS232C, never connect pin numbers 12, 13, 18, 19, 23 and 25 since these are signal wires for the teaching pendant.
- * Pin numbers 4 and 5 are shorted.
- * Since pin numbers 18 and 19 are connecting terminals for the ENABLE SW, it is necessary to connect these when the servo is ON.
- * TEACHING/RS232 PORT SW

PORT SW (ON) The teaching pendant or RS232 communication lines can be used.

PORT SW (OFF) The connector function stops.

The pin numbers 12 and 13 EMG SW and the pin numbers 18 and 19 ENABLE SW are shorted internally.

4. Specifications

4.5 PORT

MPG Connector

Pin No.	Signal Name	Wire Color
1	5V	Red
2	GND	Black
3	PG A	Gray
4	PG B	Yellow
5	PG Z	Green
6	PG \bar{Z}	Brown
7	FG	Clear
8	U	Red
9	V	White
10	W	Black

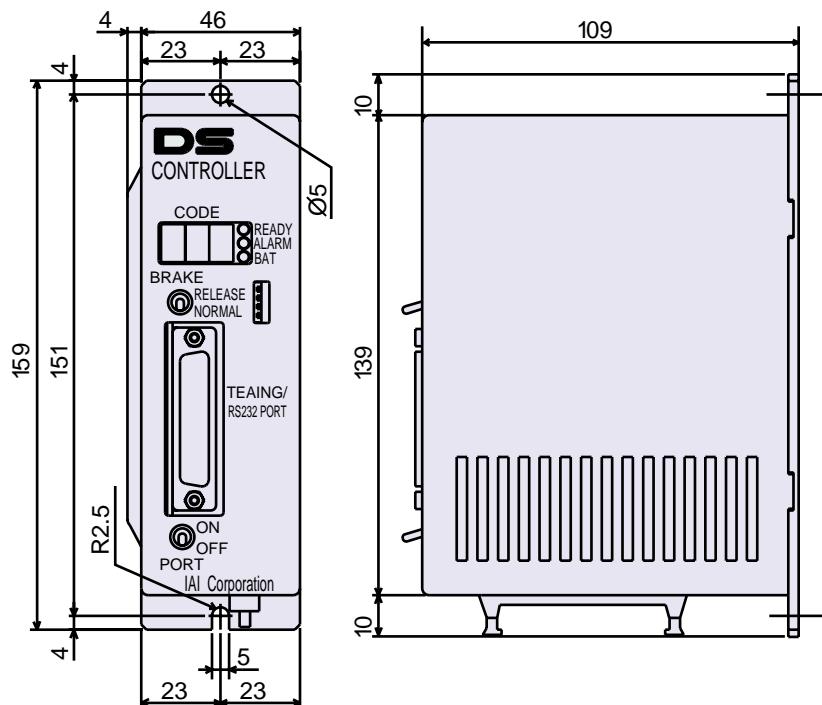
BK Connector

Pin No.	Signal Name
1	BK+
2	BK-

5. Dimensions

5.1 Plastic Type

Controller DS-S-C1



6. Installation Environment and Noise Measures

DS
Controller

6.1 Installation Environment

- (1) Do **NOT** block the air vents of your controller during installation and wiring.
(Not only will insufficient ventilation prevent optimal performance, but it may lead to a malfunction in the controller)
- (2) Your DS Controller is **NOT** dust, water, or oil proof. Take steps to prevent foreign matter from getting into the controller air vents. Avoid using your controller in environments subject to contamination by dust, oil mist, or cutting oil.
- (3) Do not expose your controller to direct sunlight or place it near a heat source.
- (4) The controller should be used in an environment where the ambient temperature is 0°C ~40°C, humidity 85% or less (no condensation) and is free of corrosive or inflammable gases.
- (5) Avoid external vibration, unnecessary impact, or excessive shocks to your controller.
- (6) Take steps to shield all cables and wires from electromagnetic noise.

6.2 Power Source

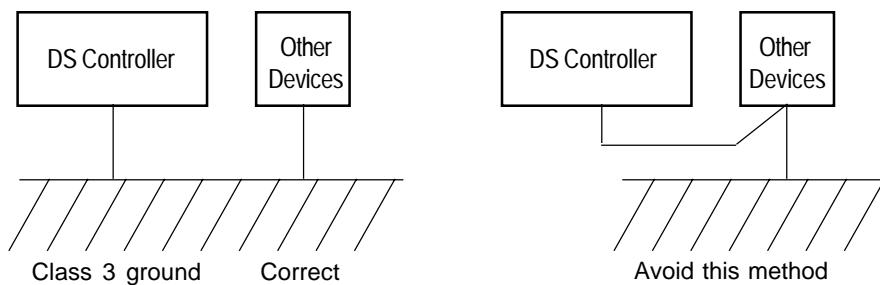
Power supply is DC24V.

6.3 Noise Suppression

This section explains noise suppression measures when using the controller.

(1) Wiring & Power

For grounding, please use a dedicated ground of Class D or better. The thickness of the cable should be 2.0~5.5mm² or larger.



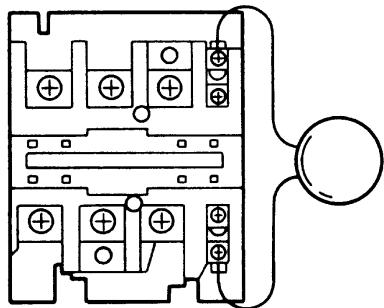
6. Installation Environment and Noise Measures

(2) Noise Source and Noise Suppression

Noise comes from many sources but the most immediate when building a system are solenoid valves, magnetic switches and relays. Noise from the devices can be prevented by taking the following steps:

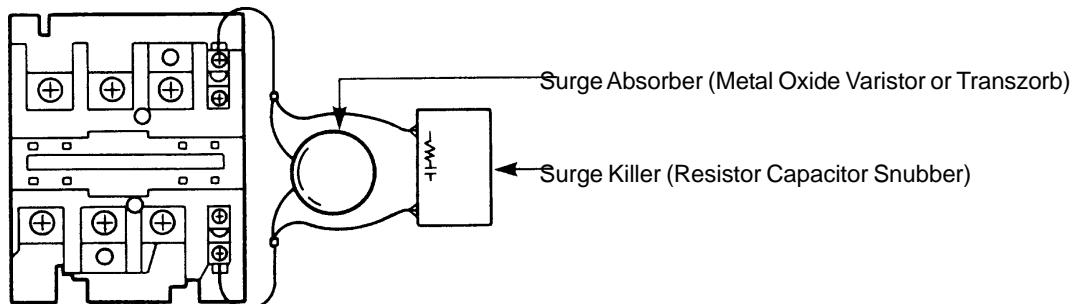
AC solenoid valve · magnetic switch · relay

- Install a surge absorber parallel to the reactance load (solenoid and relay coils).



Note Use the shortest possible wiring between the surge absorber and the noise-creating device. Use of excessively long wiring will decrease the performance of the surge absorber.

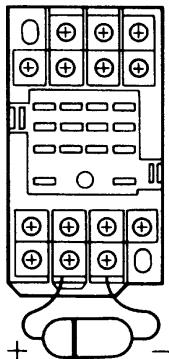
- The most effective method is to install a surge absorber and surge killer in parallel to the reactance load (solenoid and relay coils). This will reduce noise in a wide band of frequencies.



6. Installation Environment and Noise Measures

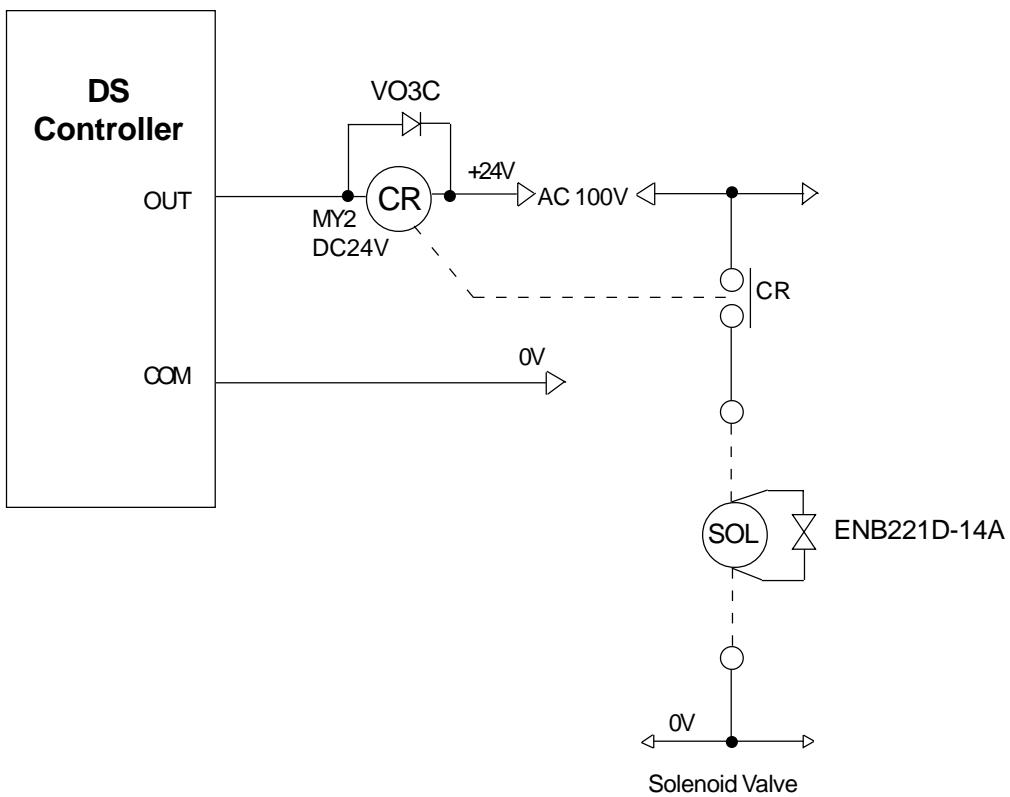
DS
Controller

Install a diode in parallel with a coil • Diode Capacity is determined by the load capacity.

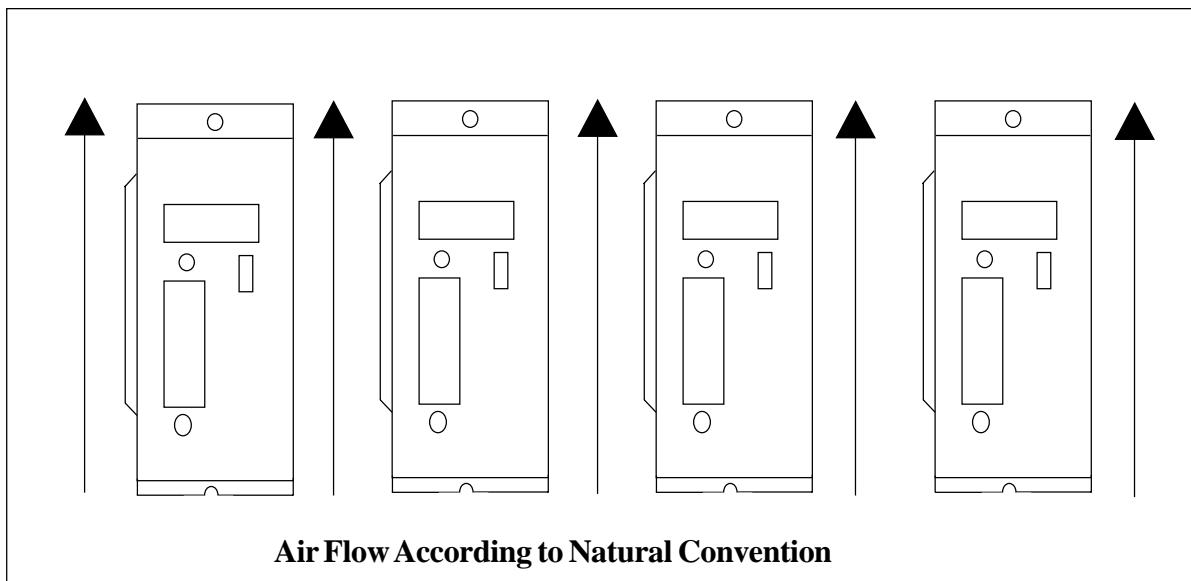


In the case of DC power, be careful not to exceed the diode polarity as this can lead to a breakdown of the diode, inside the controller or of the DC power.

Circuit Example



6.4 Heat Dissipation and Mounting



This controller is designed for assembling inside the control board. Since the heat dissipation for this controller is about 10~12W, cooling is done according to natural convention. As for the spacing between the controllers, whether or not it's a single or multiple controllers, please leave enough space so that controller mounting and removal may be done easily.

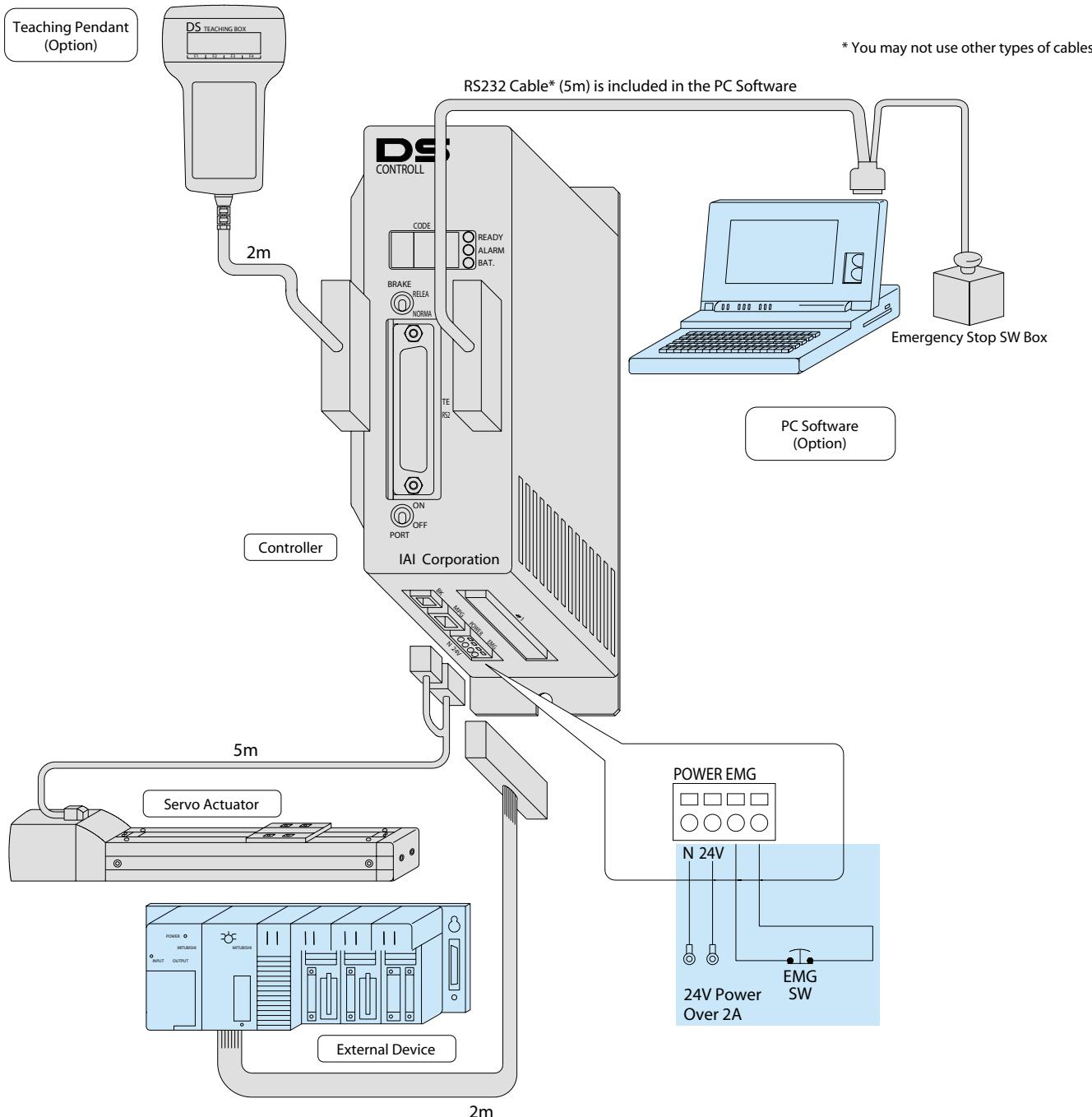
6.5 Power Supply to the Controller

- (1) Please make sure that the power is OFF when wiring into to the I/O connector and main power.
- (2) Please make sure that the N(OV) is common when setting the main power and I/O power separately.
- (3) To maintain safety during emergency stop, when cutting off the main power of the controller, close/open just the 24V side.

7. Connections

7.1 Connection Method

Please make sure that all connectors are plugged in correctly and securely. Excluding the TEACING/RS232 PORT, do **NOT** plug or unplug the connectors while the power is ON!



7. Connections

DS
Controller

- (1) Connect the motor · encoder cable and brake cables coming from the actuator to the connector.
- (2) Connect the teaching pendant to the controller. After connecting, turn the PORT Switch ON.
(If it is OFF, the teaching pendant will not work when the power is turned ON)
- (3) Supply 24V power to the controller terminal block (power).
 - a) Power Terminal Block, as shown on Page 6.
 - b) External I/O device connector, between Pin No. 1A (24V, cable color brown) and Pin No. 17B.
(OV cable color yellow).
- (4) If the CODE display shows, 「**POW** → **EN** → **SPW** → **PR** → **RDY**」 in sequence, then, the DS Controller is ready to operate.

If the CODE display shows, 「**EM**」 then, the EMERGENCY STOP input will release.

- a) Power 24V DC must be supplied to the external I/O.
- b) Input pin No. 5A for the external I/O should be logically OFF.

If the CODE display is, 「**RES**」 then, either a CPU reset has been input or I/O current is disconnected.

The controller preparation is now complete.

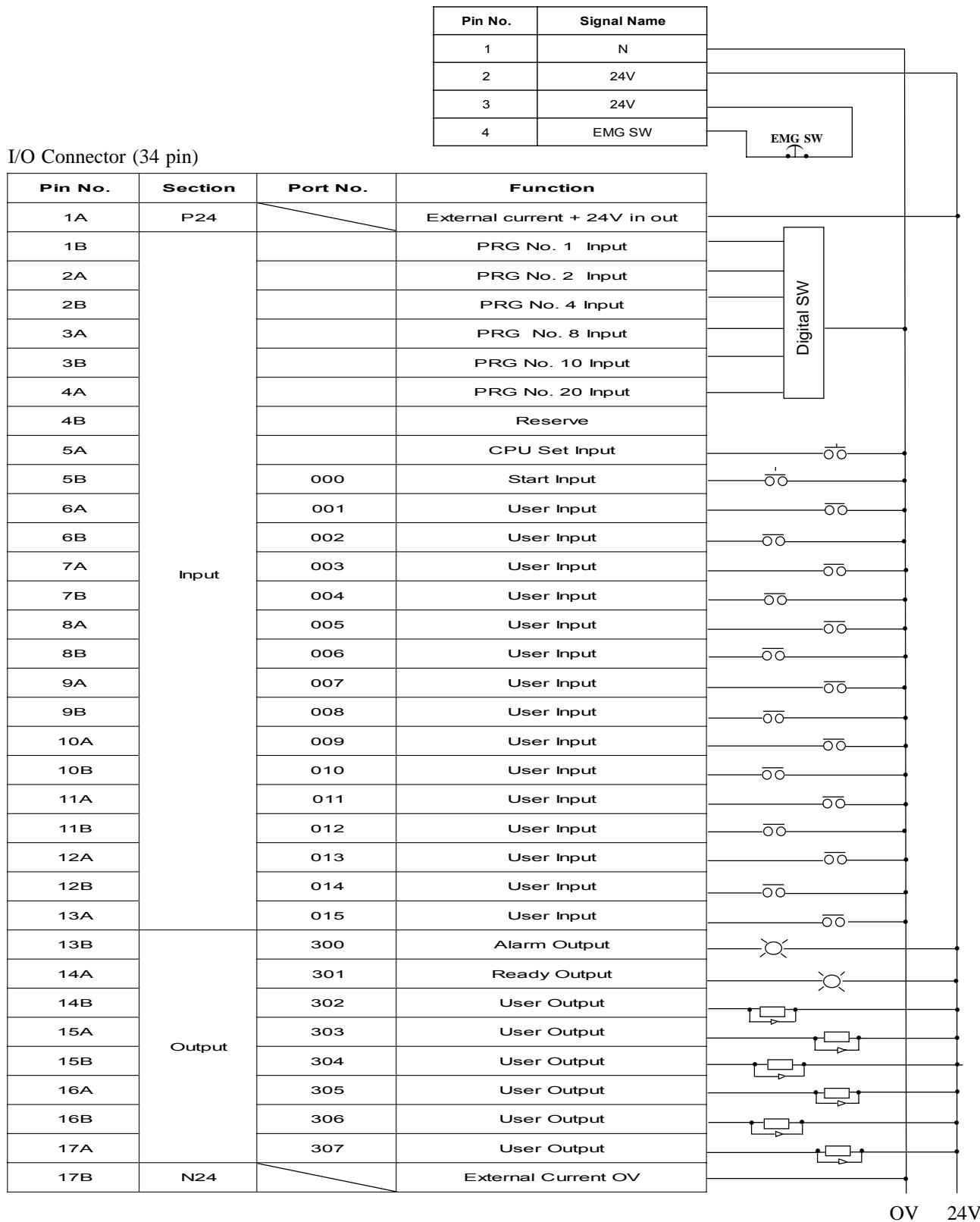
Note 1: The controller terminal block (EMG) is for connecting an emergency stop switch and is a b-type contact input (normally closed). When the unit is shipped, it is shorted and the emergency stop is released.

Note 2: Do not recycle power quickly.

7. Connections

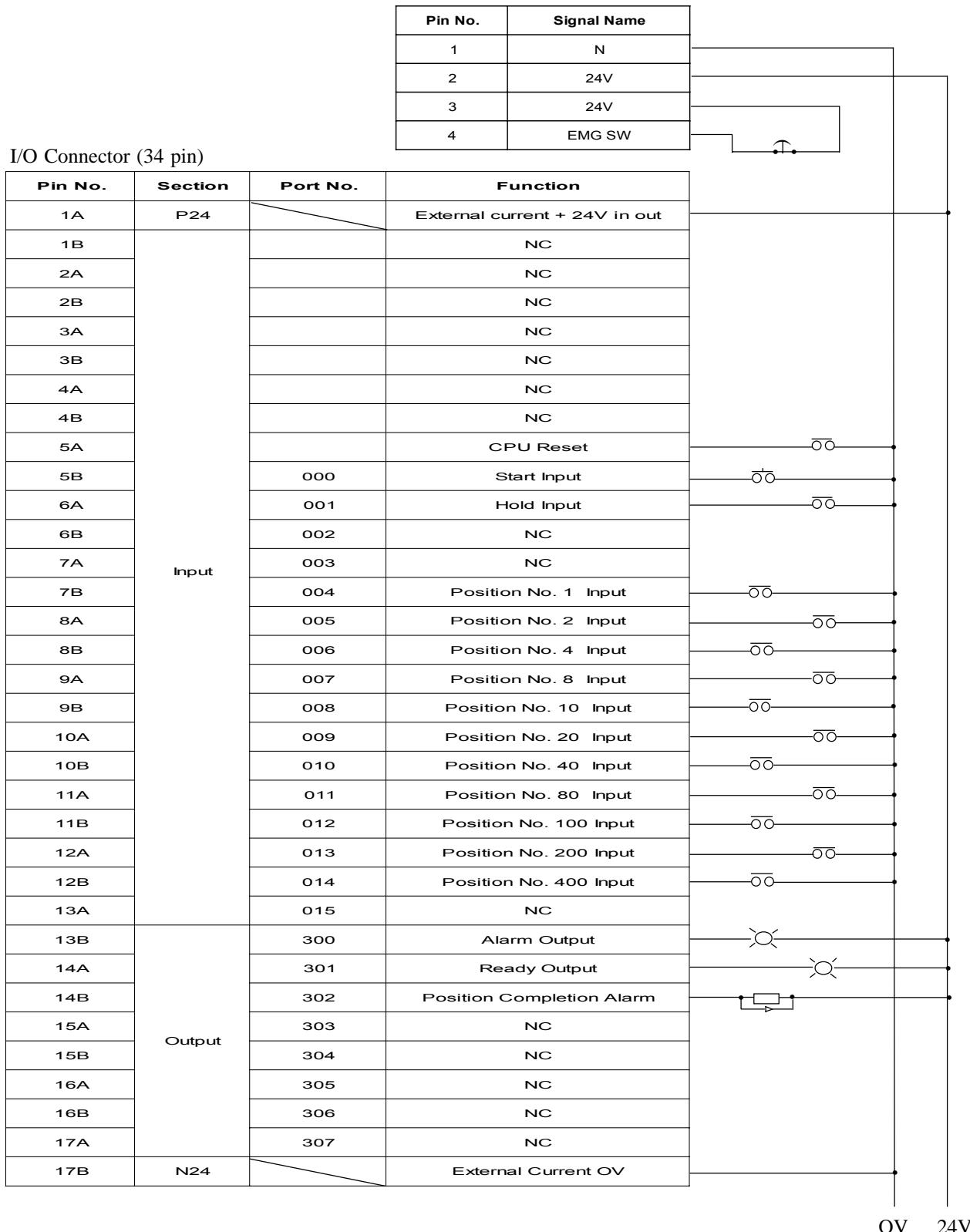
7.2 Diagram of External Device Connector

The following is an example of connections with an external device in the **program** mode.



7. Connections

The following is an example of connections with an external device in the **position** mode.



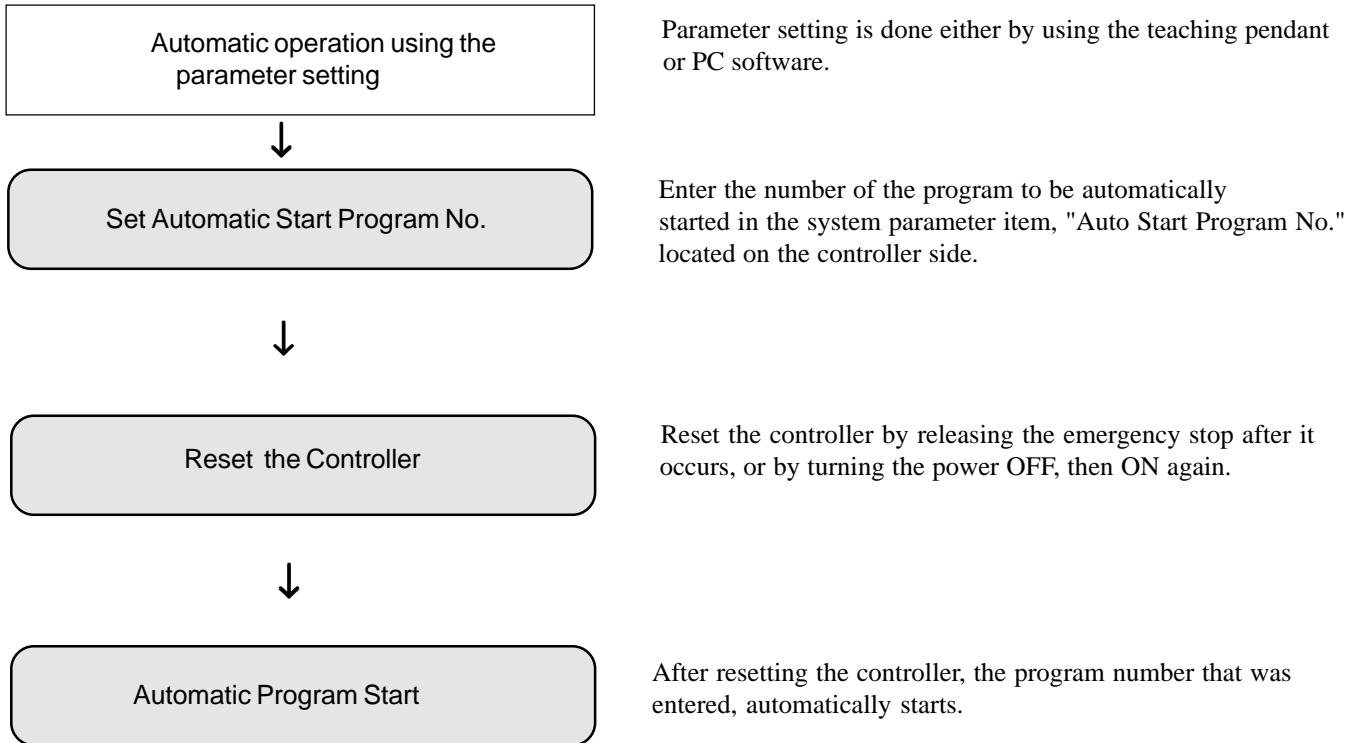
OV 24V

8. Moving the Actuator

There are two ways to move the actuator. One is the program mode where a program in the memory drives the actuator, and the other is the positioning mode where the actuator is moved between recorded positions.

8.1 Program Mode

There are two methods of operating the actuator in the program mode. The first is "operation from a teaching pendant" and "operation using the PC software" which are used for simple operating checks (during program debugging on a trial run). The second is "automatic operation based on parameter settings" and "operation based on selection of external signals" which are used in general application examples on site. The following section explains the second method.



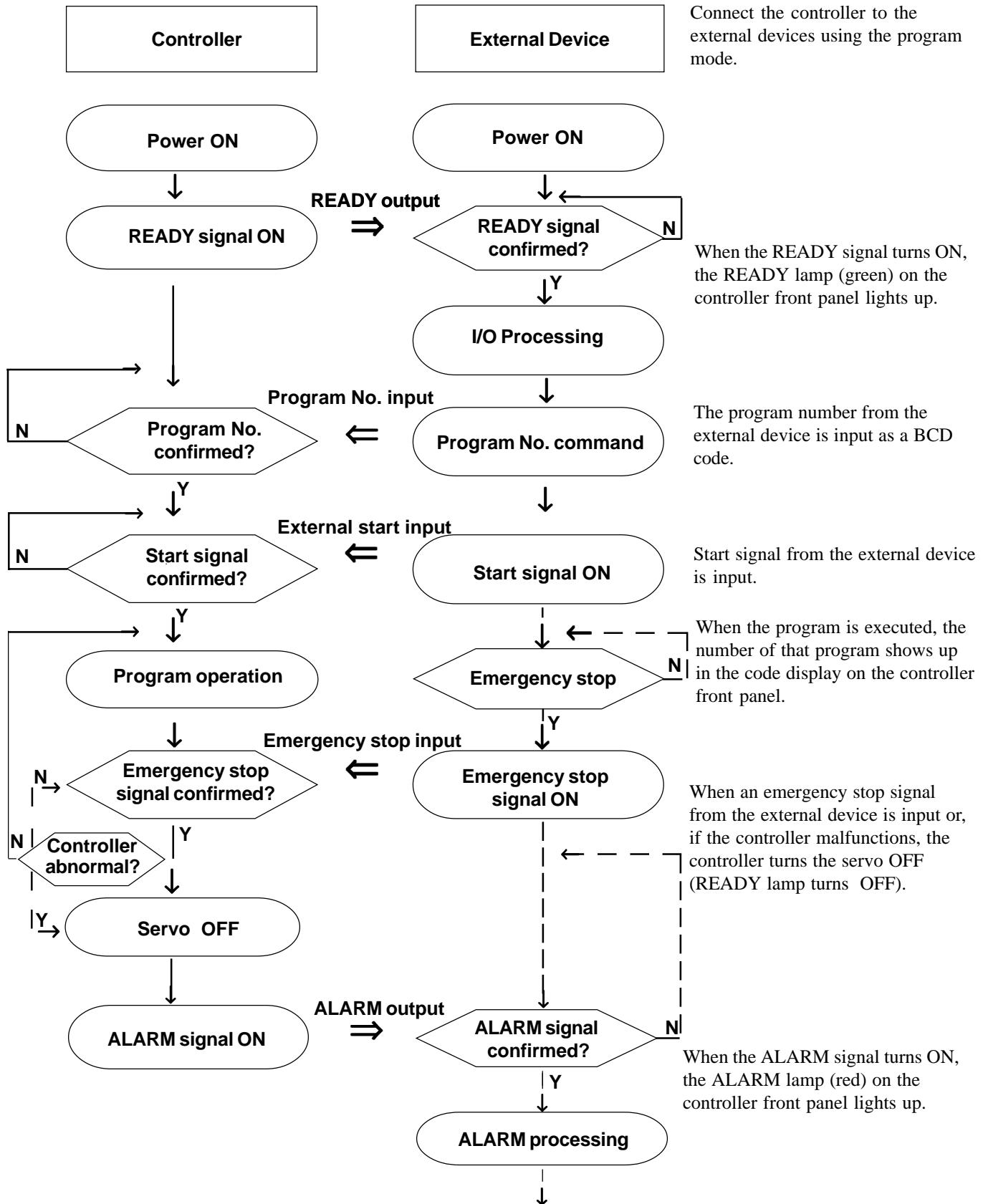
Precautions when using an auto start program:

The servo actuator will start automatically, immediately after the controller is reset which may startle the operator. To ensure safety, always use an interlock at the start of a program, such as having the actuator operate after receiving a confirmation signal. To start simultaneous multiple-programming, set all other programs into EXPG command, placing them ahead of the main auto program. As always, please take safety precautions when using an auto start program.

8. Moving the Actuator

Operation Based on the External Start Signal Selection

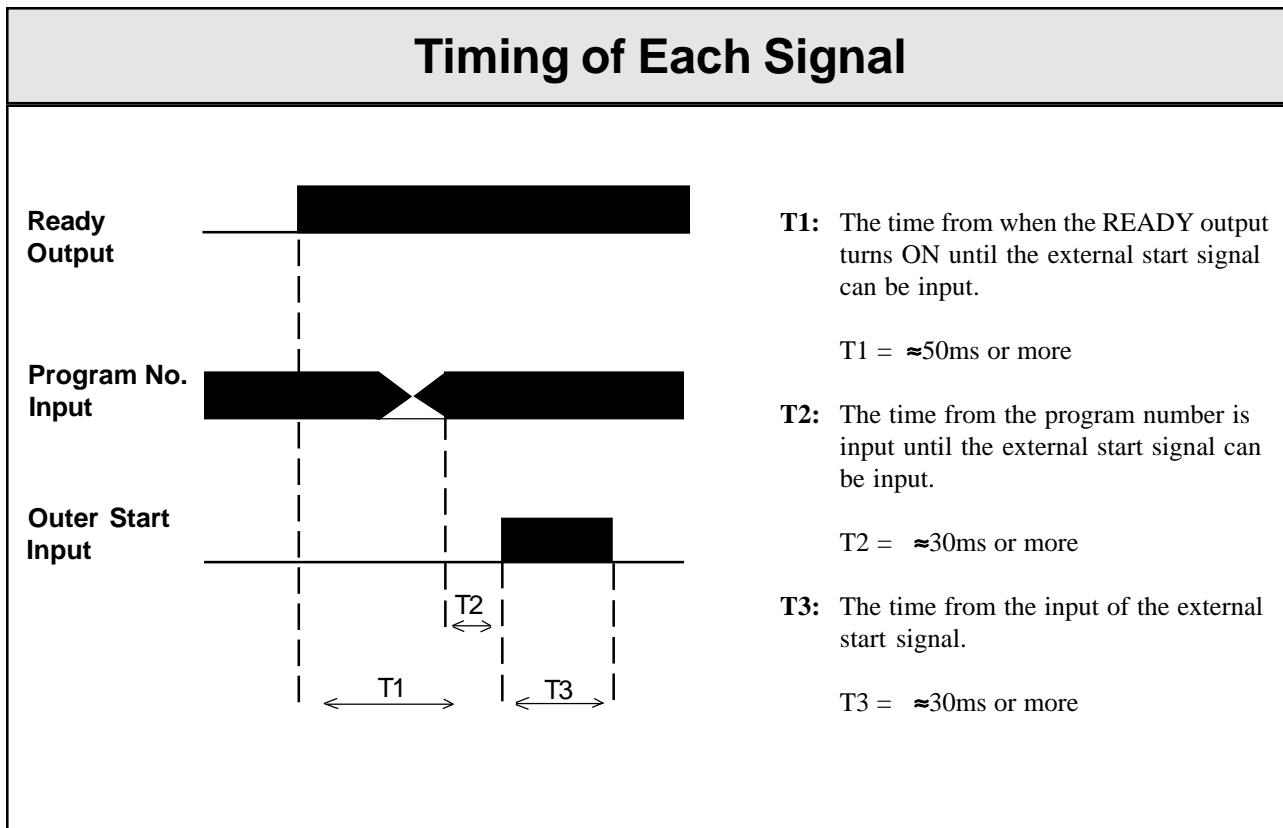
(1) Program Operation



8. Moving the Actuator

(2) Timing of Each Signal

When exchanging signals with an external device, timing becomes critical. See the timing charts that follow:

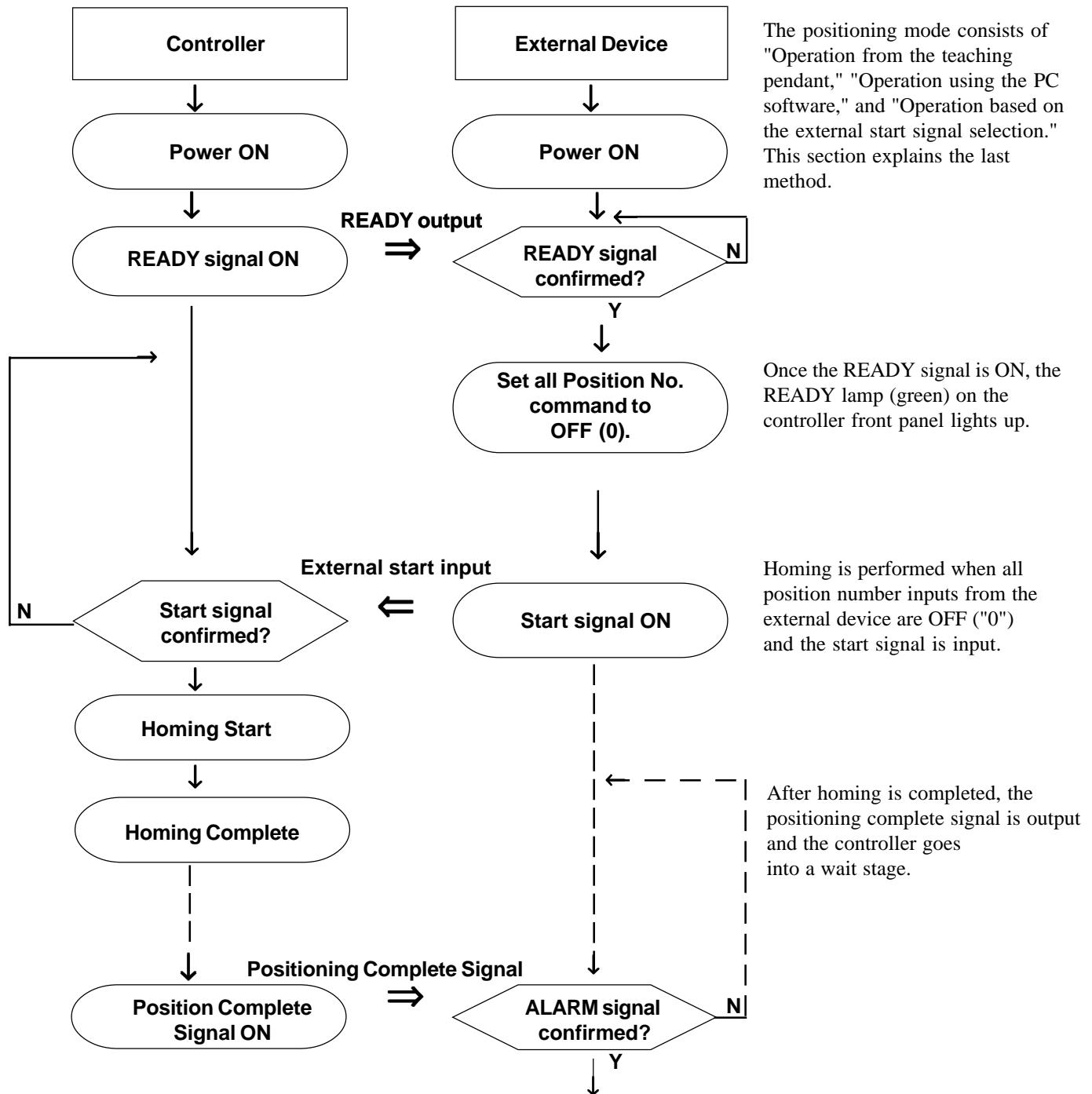


8. Moving the Actuator

8.2 Operation Using the Positioning Mode

Operation Based on the External Start Signal Selection

(1) Homing

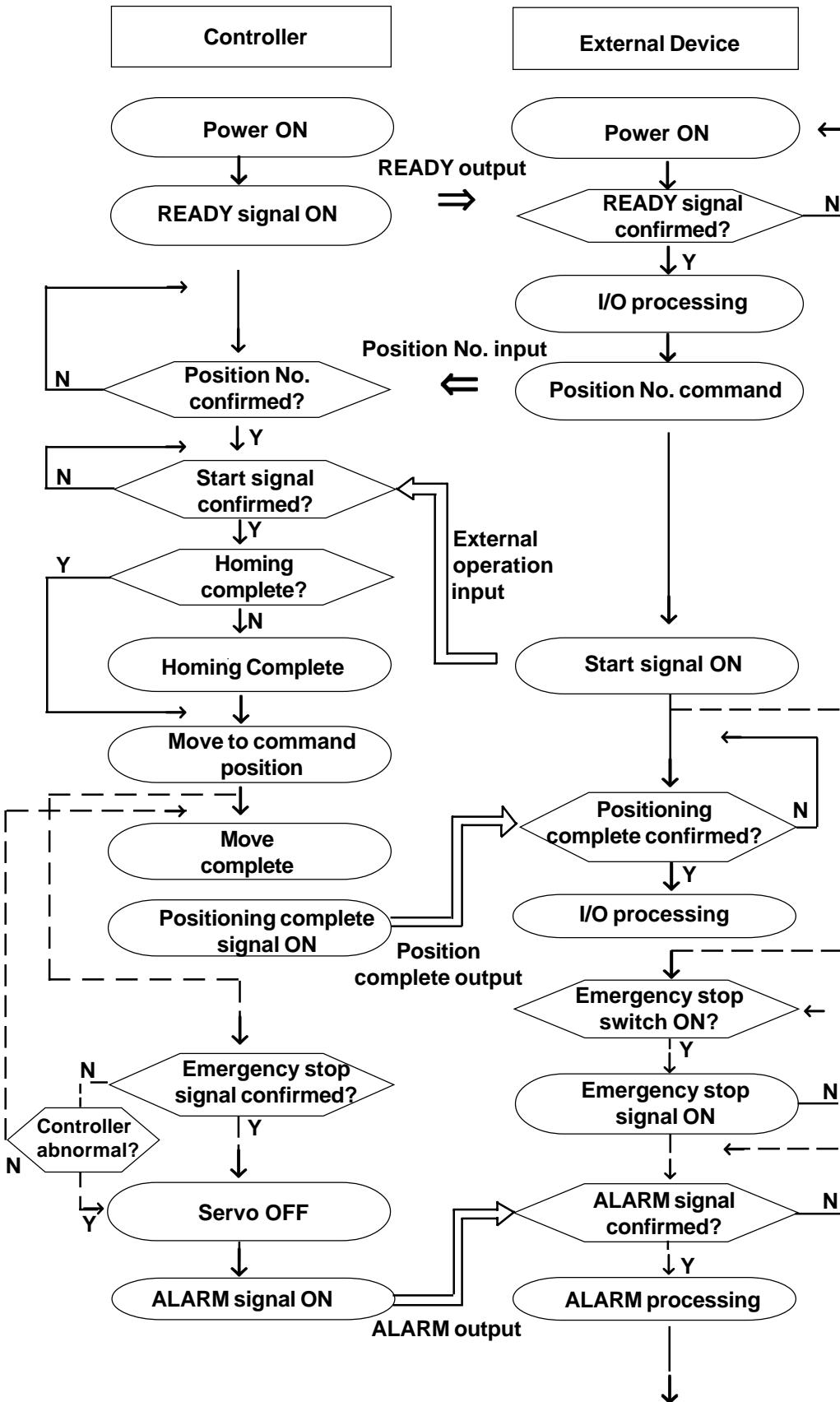


NOTE:

By homing, for later operations, commands from the external device have priority. When switching over to an operation from the teaching pendant or using a PC software, perform homing after cutting the power once.

8. Moving the Actuator

(2) Positioning



When the READY signal turns ON, the READY lamp (green) on the controller front panel lights up.

The program number from the external device is input as a BCD code.

Note 1:
When a position number greater than 501 is designated, the signal is disregarded.

Note 2:
When there is no data in the designated position number, the signal is disregarded.

Note 3:
If homing has not been performed and a position is designated and a start signal input, the actuator will home first and then, move to the position.

- | When the move is completed, a positioning complete signal is output.

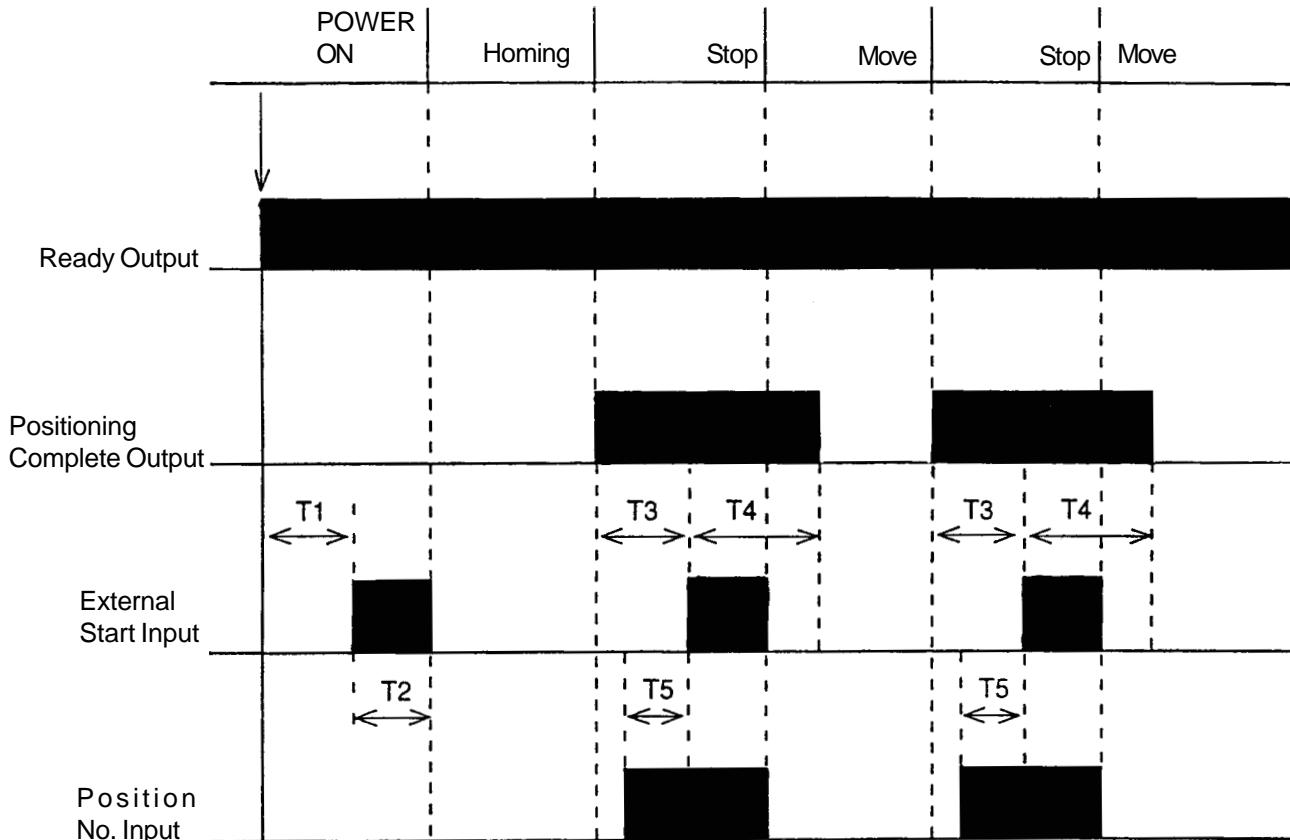
When an emergency stop signal from the external device is input or, if the controller malfunctions, the controller turns the servo OFF (READY lamp turns OFF).

When the ALARM signal turns ON, the ALARM lamp (red) on the controller front panel lights up.

8. Moving the Actuator

(3) Timing of Signals

When exchanging signals with an external device, timing becomes critical. See the timing charts that follow:



T1: The time from the READY signal ON to homing start input.

T2: External start input (over 30msec).

T3: The time from the the previous positioning complete output ON to when the external start signal input can be entered (50msec).

T4: The time it takes from external start input ON to positioning complete output OFF.

T5: The time it takes to input from position number input to external start.

* The interchange timing of each position number input is effective after receiving external start input.

* Alarm Output

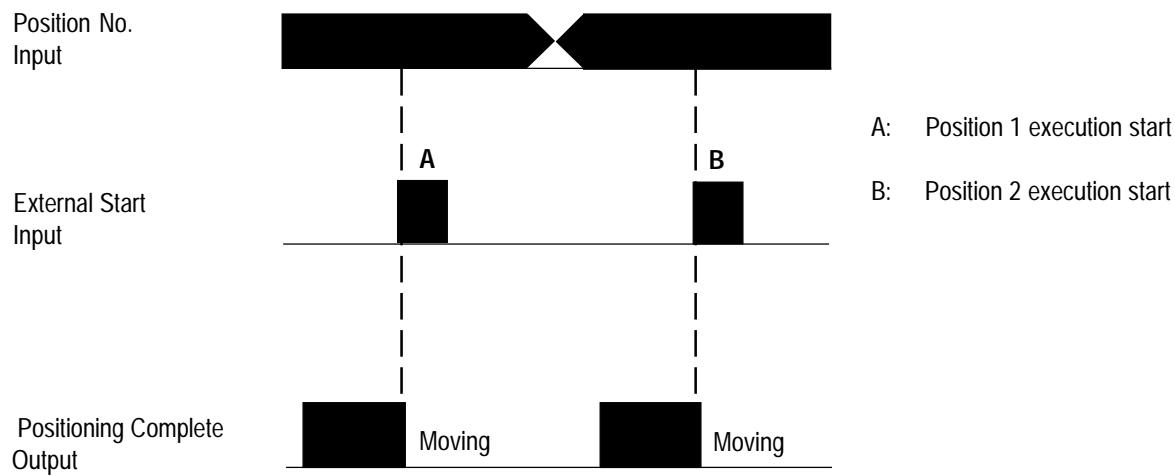
During emergency stop input, and during CPU reset input, outputs when the protective function of the controller operates. Upon releasing the input of the emergency stop, or by releasing the input of CPU reset, the controller will restart.

* Position Number Input

Input is possible up to 500 positions using the BCD input.
(Example): No.100+No.20+No.4+No.1=Position No. 125

8. Moving the Actuator

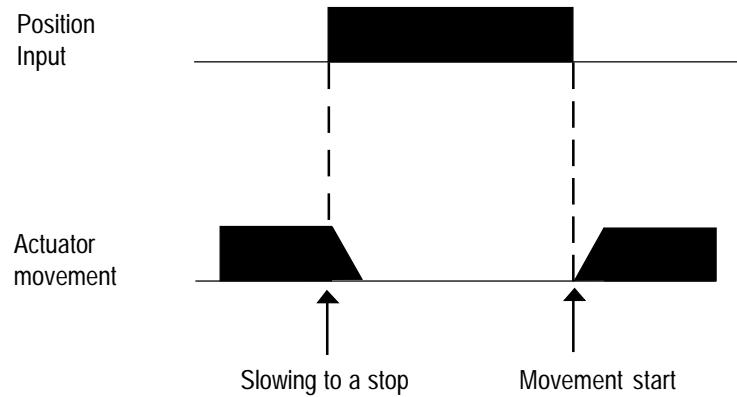
(4) Timing for Position No. Switching



The timing for position number shifting is the time from after the position presently being executed is completed until the next external start input (start signal) can be input.

8. Moving the Actuator

(5) Timing of Motion Using a Hold Signal



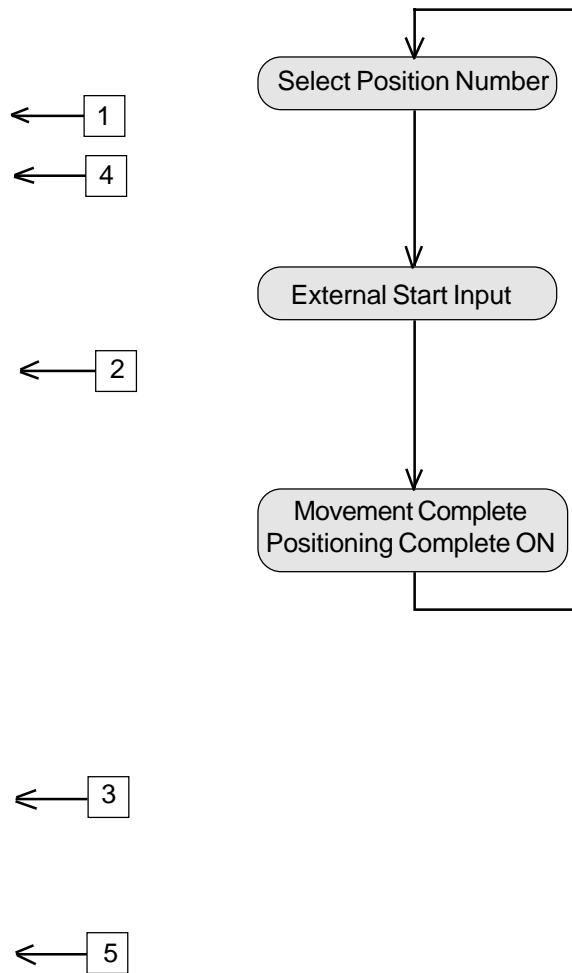
The servo actuator is slowed to a stop by turning the hold signal ON while the actuator is moving and starts up again by turning the hold signal OFF.

8. Moving the Actuator

(6) Movement in Random Sequence

To move the actuator in a random order, select the position number and input external start signal for each movement.

Position No.	Acceleration	Velocity	Position
1	0.3	100	50.000
2	0.3	100	200.000
3	0.3	200	100.000
4	0.3	200	250.000
5	X.X	XXX	XXX.XXX
6	0.3	300	150.000
7	0.3	300	150.000
8	X.X	XXX	XXX.XXX
9	X.X	XXX	XXX.XXX
.	.	.	.
.	.	.	.
.	.	.	.
492	X.X	XXX	XXX.XXX
493	X.X	XXX	XXX.XXX
494	0.3	200	150.000
495	0.3	200	380.000
496	0.3	200	400.000
497	0.3	200	200.000
498	0.3	100	250.000
499	X.X	XXX	XXX.XXX
500	X.X	XXX	XXX.XXX



9. Error Code list

When an error occurs, the alarm LED (red color) on the controller's front side will light up. At the same time, the I/O alarm output will turn ON and the READY output will turn OFF.

Error Code List

Error Code	Error Name	Explanation
A1	External Interrupt Error	1. Motor over current 2. Over regenerative current (over negative load) 3. Driver overheat
A2	Motor Overload Error	Mechanical overload of motor
A3	Deviation Error	Motor is unable to perform properly due to mechanical overload
A4	Software Limit Error	Exceeded software limit
A5	Pole Sense Error	Unable to sense pole
B0	No Program Error	Program does not exist
B1	Program Execution Error	Execution of a currently executing program
B2	Program Over Error	Number of tasks exceeds those set as parameters
B3	Double Subroutine Number Error	Two or more of the same subroutine number are used
B4	Double Tag Number Error	Two or more of the same tag number are used
B5	Undefined Subroutine Number	Subroutine number is not defined
B6	Undefined Tag Number	Tag number is not defined
B7	Subroutine Pair Error	BGSR and EDSR are not the same quantity
B8	Step 1 BGSR Error	Step 1 is a BGSR Error
B9	DO, EDDO Pair Error	DO and EDDO are not the same quantity
BA	DO Nest Over Error	DO was used more than 15 times
BB	IF Pair Error	IF and ELSE are not the same quantity
BC	ELSE Error	ELSE was used in a place which was not between IF and EDIF
C0	No Homing Error	Homing was not performed before running actuators
C1	Point Data Error	Attempt has been made to execute unregistered point data
C2	Axis Double Execution Error	Move command given to axis currently moving
C3	Software Limit Error	Software limit exceeded in program
CE	S Motion Percent Error	S motion percent was set outside the range of 0 ~ 50%
D0	Acceleration Error	Acceleration exceeds limits
D1	No Velocity Error	Velocity has not been set
D2	Override Error	Override was set outside the range of 1 ~ 100%
D4	Axis Pattern Error	Axis pattern was not set correctly. Displays D4 also for C1 (point data error)
D5	Axis Number Error	Axis number was set outside the range of 1 ~ 8
D7	Program Number Error	Program number exceeds the limit
D8	Position Number Error	Position number exceeds the limit
D9	Point Number Error	Negative number was input in the point number
DA	Flag Number Error	Flag is not assigned correctly
DB	Variable Error	Variable is not assigned correctly
DC	Digits Over Error	Assigned number exceeds 8 digits (binary 32 bits)
DD	Division (0) Error	Result of the division is "0"
DF	Task Level Error	Task level was set outside of the range of 1 ~ 5
E0	Undefined Command Error	Attempted to execute undefined command
E1	Subroutine Over Nesting Error	Nesting of more than 15 subroutines
E2	Subroutine Under Nesting Error	EXSR and EDSR are not making a pair
E3	Controlling Column Error	Use of condition is not correct
EG	EMG Error	Emergency (Emergency Stop) was asserted
F0	Interrupt Error	Motor CPU and Interrupt management do not match

Note: An "E" appears at the head of the error code, followed by 3 digits.

10. Maintenance



To ensure safe and trouble-free operation of your system, a regular maintenance and inspection program should be implemented. Be sure to turn OFF the power before initiating any maintenance or inspection work. An inspection is recommended at least once every 6 to 12 months. However, depending on the environment, a more frequent inspection schedule may be advisable.

(1) Inspection Guidelines

- Check and make sure that the power supply to your controller is within the specification range (DC24V±10%).
- Check the controller vents and clean any accumulated dirt or dust.
- Check the controller cable (controller → axis) and make sure that there are no loose screws or disconnections.
- Check for loose controller mounting screws. Tighten if necessary.
- Check each cable (axis cables, general I/O cables, system I/O cables, power supply cable). Check for loose connections, damage, or excessive wear. Replace if necessary.

(2) Recommended Spare Parts

Should a breakdown occur, even if it is discovered early, repairs can not be done if there are no spare parts.

It is advisable to keep a small supply of spare parts, especially for those parts that wear down with use.

The following spare parts are recommended:

- Cables
- Batteries
(Ni-Cd batteries have a general shelf life of about 6 years but this varies depending on use conditions and environment)

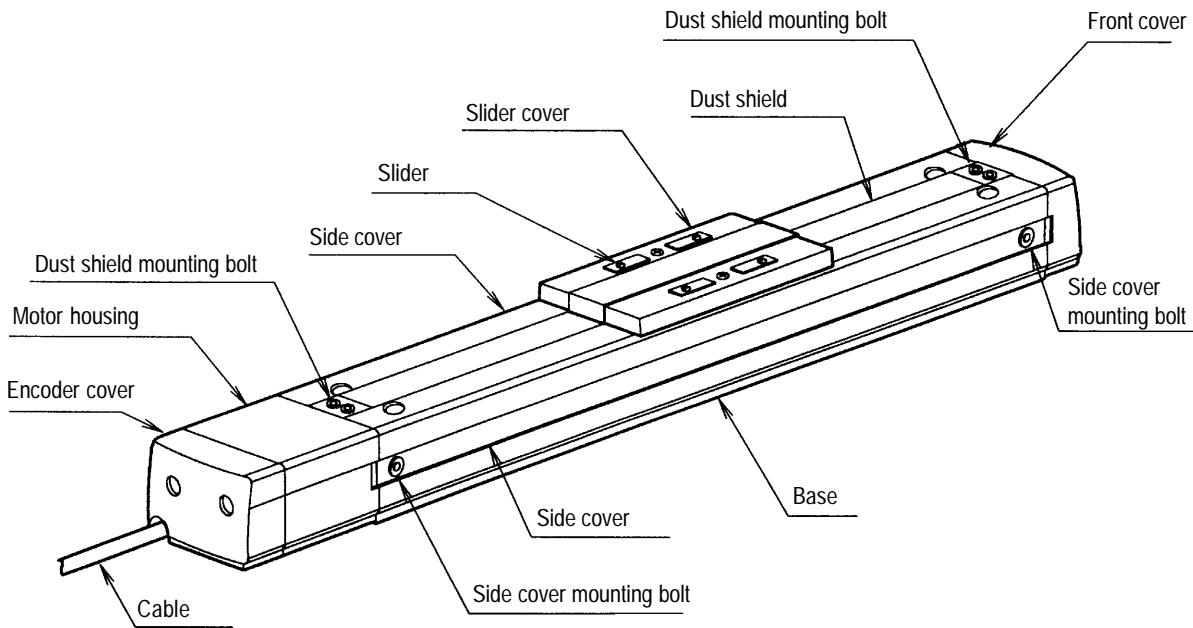
(3) Memory Backup

When the controller is fully charged, the backup memory is guaranteed for 3 months. In actuality, the backup memory is not erased for 6-8 months but if the controller is to be left for a long period (more than 3 months) without having current run through it, please take precautions to save your program, position data, and parameters. To fully charge the controller if it does not contain any data, you will need to leave the controller with the power ON for 3 days. If the memory is erased, the system's preset parameters will be set but the actuator will not run properly in this condition.

1. General

DS
Slider Type

1.1 Part Names



Please note the following when handling the actuator.

- To handle the actuator, support it from underneath or grasp the area around the side cover mounting bolts.
- Do not place excessive load on the cable.
- Do not place heavy loads on the encoder cover, slider cover or other plastic parts.

1.2 Operating Environment

Install the actuator in a place where the operator can work without protective gear. See the table below for specific operating environment criteria.

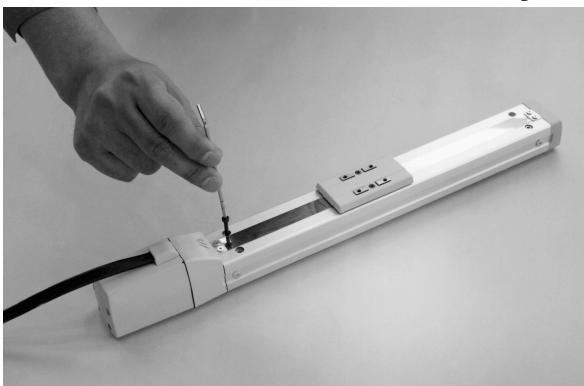
No.	Operating Conditions
1	Ambient temperature 0~40°C
2	Relative humidity 35~90%
3	Avoid direct sunlight
4	Avoid exposure to water, cutting oil and other liquids
5	Avoid exposure to corrosive or combustible gas
6	Minimal dust
7	Do not subject to vibrations or shock greater than 0.5G
8	Avoid strong electromagnetic waves, ultraviolet rays and radiation

2. Installation

DS
Slider Type

2.1 Installing the Actuator (SA4, SA5 Type)

Mount the actuator to a machined surface or one of comparable precision. Install the actuator as shown below.



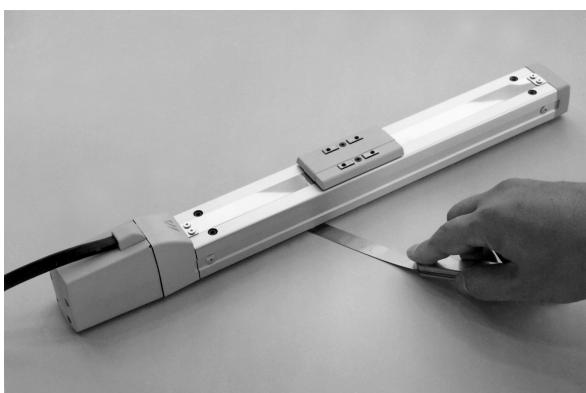
The actuator base and lower surface are parallel to the guide. When travelling precision is required, use this surface as a reference to mount the actuator. For basic mounting, use the four mounting holes located on the upper surface of the actuator.

The reamer holes on the back side for positioning pin may be used as needed.

Machine Type	When opposite material is copper	When opposite material is aluminum
DS-SA4	M3X35	
DS-SA5	M4X40	M4X45

For mounting bolts, depending on the material of the foundation side, use the bolt with hexagonal holes as indicated below.

Machine Type	Reamer Hole	Depth
DS-SA4	Φ3H10	Under 5mm
DS-SA5	Φ4H10	Under 5mm
DS-SA6	Φ4H10	Under 5mm

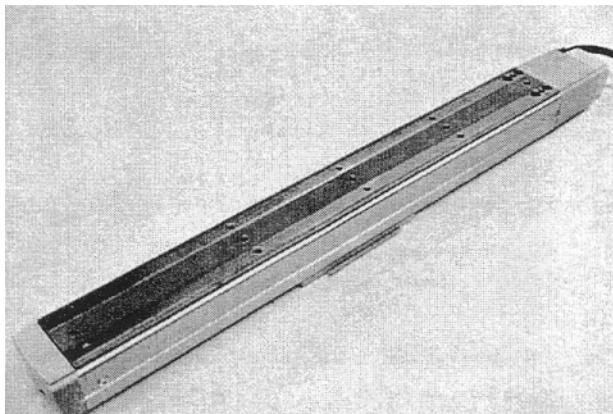


Rest the actuator on the mounting surface and check to see that a 0.1mm thickness gauge cannot be inserted at the four mounting holes. If the bolts go in a steel surface with tapped holes, then use hexagon sockets with length shown in ① and if the surface is a light metal, use the length in ②.

2. Installation

DS
Slider Type

(S6 Type)



On the base of the actuator, you can use the two mounting holes at the motor end and the tapped holes on the underside of the base but please make note of the following.

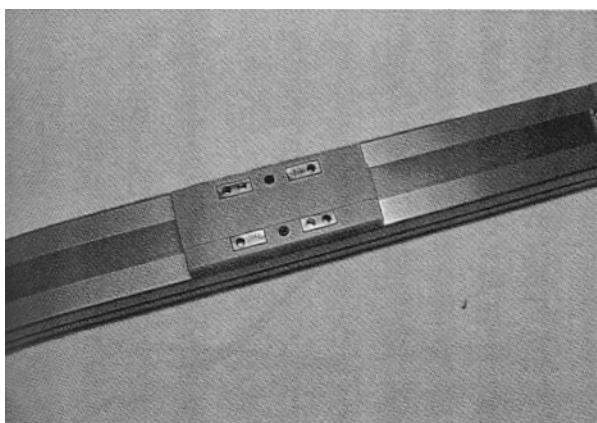
Back Side Mounting Tap Holes

Machine Type	Bolt Size	Tap Depth	Engagement depth
DS-SA4	M3	5mm	Over 3mm Under 5mm
DS-SA5	M4	7mm	Over 4mm Under 7mm
DS-SA6	M5	9mm	Over 5mm Under 9mm

Suggested Tightening Torque

Bolt Size	When the bolt surface is steel	When the bolt surface is aluminum
M3	1.6N • m (0.16kgf • m)	1.1N • m (0.11kgf • m)
M4	3.7N • m (0.38kgf • m)	2.3N • m (0.23kgf • m)
M5	7.5N • m (0.77kgf • m)	4.3N • m (0.44kgf • m)

2.2 Attaching the Workpiece



Use the four tapped holes at the top of the slider to attach the workpiece.

2. Installation

DS
Slider Type

To attach the workpiece, select bolts that will have the engagement lengths indicated in the table below and adjust the length of the washer if necessary. Make sure that the workpiece does not touch the slider cover, and note the following:

Machine Type	Slider Mounting Area	Engagement Depth
DS-SA4	M3 depth 7mm	Over 3mm Under 7mm
DS-SA5	M4 depth 9mm	Over 4mm Under 9mm
DS-SA6	M5 depth 9mm	Over 5mm Under 9mm

Bolt Size	When the bolt surface is steel	When the bolt surface is aluminum
M3	$1.6N \cdot \text{m}$ (0.16kgf · m)	$1.1N \cdot \text{m}$ (0.11kgf · m)
M4	$3.7N \cdot \text{m}$ (0.38kgf · m)	$2.3N \cdot \text{m}$ (0.23kgf · m)
M5	$7.5N \cdot \text{m}$ (0.77kgf · m)	$4.3N \cdot \text{m}$ (0.44kgf · m)

2.3 Wiring Cable

The actuator cable is resistant to bending fatigue but it is not robot cable. Avoid housing the cable in movable wire duct with a small radius. In an application where the cable cannot be anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable hose as large radial wire duct to limit the load on the cable.

2.4 Adjusting Home Position

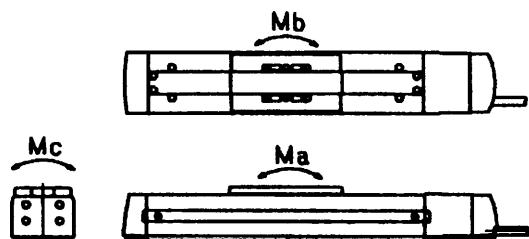
After installing the actuator, perform the homing operation to confirm home. Home direction can be changed with the parameters. If you allow a large offset amount, the moving range is limited by that amount. If you specify an offset amount greater than 1mm, you will have to reset the software limit and reduce the stroke by that amount.

Note: To change the home offset amount requires the optional PC software.

2.5 Load on the Actuator

Do not exceed the load shown in the specification table as indicated in Chapter 4 of this manual. Please note in particular the slider moment and allowable overhang length and the load weight.

The base of the actuator warps easily when it is used with an overhang so please keep the Ma and Mc moments under 1/2 of the rated value.



3. Maintenance

DS
Slider Type

3.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

Maintenance Checkpoints

	Visual inspection	Check for loose dust shield	Check interior	Lubrication
Start operation	<input type="radio"/>			
After 1 month of operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
After 6 months of operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Semiannually thereafter	<input type="radio"/>	<input type="radio"/>		
Annually thereafter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Note 1: The above schedule assumes running time is 8 hours per day. When running time is high such as continuous day and night operation, shorten the maintenance intervals as required.

Note 2: The motor housing supports the ball screw, so please do not disassemble. The end cover supports the ball screw so please do not remove it. Do not remove the encoder cover as this contains precision equipment.

3.2 Cleaning the Exterior

1. Wipe off dirt with a soft cloth.
2. Wipe the dust shield gently so that it does not bend.
3. Do not use strong compressed air on the actuator as this may force dust into the crevices.
4. Do not use petroleum-based solvents on plastic parts or painted surfaces.
5. If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

3. Maintenance

DS
Slider Type

3.3 Inspecting the Interior

(1) Removing the cover



Turn the power OFF. Using a 1.5mm hexagonal wrench, remove the cover as shown in the picture and visually inspect the interior.

(2) Visual check of the interior



Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the travelling surface appears shiny.

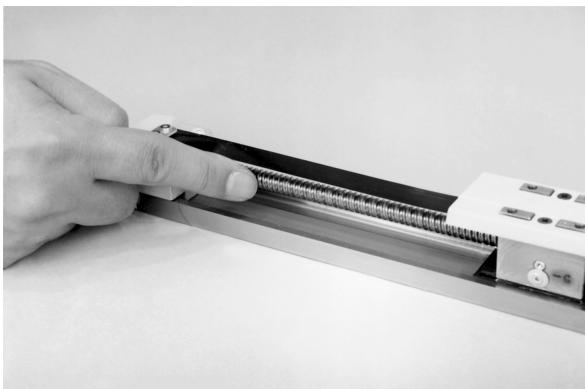
3. Maintenance

DS
Slider Type

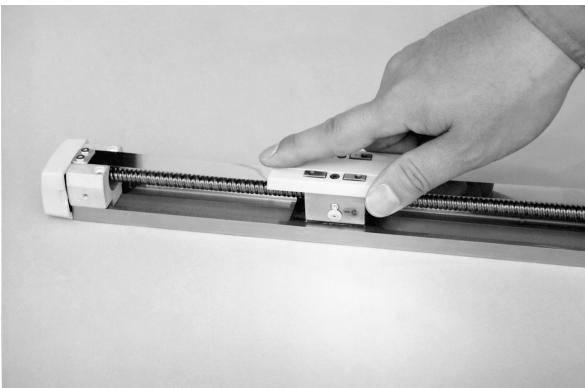
3.4 Lubrication

When the grease contains dust, becomes dull in color or begins to wear away through extended use, lubricate the actuator using the procedure below.

(1) How to lubricate



To lubricate the ballscrew, apply grease to the screw with your finger then spread it out by moving the slider back and forth.



To lubricate the slider, apply grease to the underside of the slider with your finger, then spread it out by moving the slider back and forth.

(2) What grease to use

IAI uses lithium grease No. 2. There are other brands of grease commercially available for the ballscrew and slider. These are acceptable as long as they are a lithium-type grease.

Note: Never use a fluorine-based grease. Mixing this with a lithium grease produces a chemical reaction which damages the actuator.

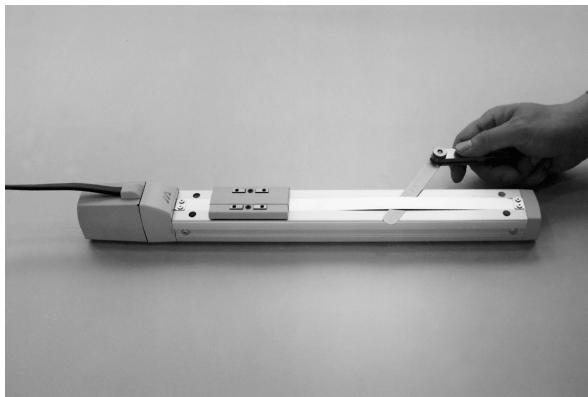
3. Maintenance

DS
Slider Type

(3) Replacing the cover



Inside the slider cover is a spring that allows it to follow along the dust shield. Lift the shield up from the bottom and attach the side cover.



If the shield is not straight, move the slider slightly to straighten out the shield. Or, lift the shield gently to straighten it out. Tighten the bolts on the side cover. The torque should be for a small plus screw (0.6Nm, 6 kgcm).

After completing the inspection, replace the cover.

3. Maintenance

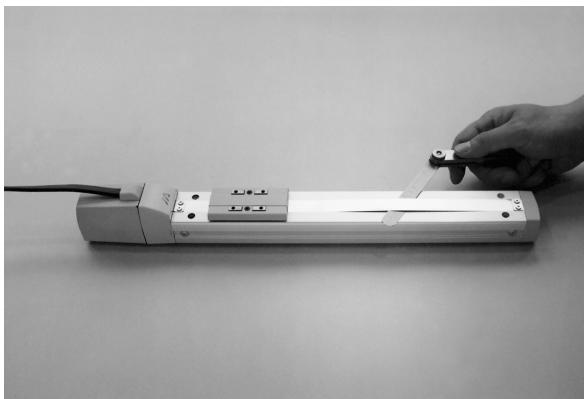
DS
Slider Type

3.5 Checking the Dust Shield

The dust shield is made from stainless steel and is adjusted at the time of shipment. If the shield slackens with use, make the following adjustments.



Move the slider to the end. Loosen the screw at the front end with a 1.5mm wrench.

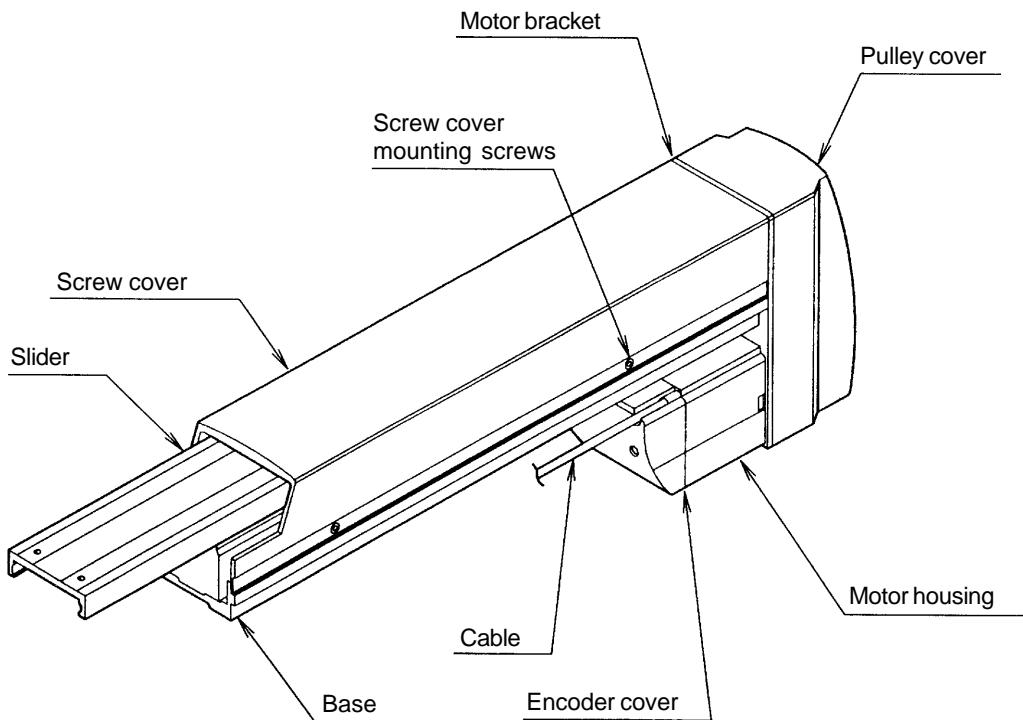


Pull the shield just enough to make it taut. Move the slider manually to make sure it moves easily. If there is resistance in the movement, there is too much tension in the shield.

1. General

DS
Arm Type

1.1 Part Names



Please note the following when handling the actuator.

- Support the base when handling the actuator.
- Do not place excessive load on the cable.
- Do not place heavy loads on the pulley cover, encoder cover or other plastic parts.

1.2 Operating Environment

Install the actuator in a place where the operator can work without protective gear. Specific criteria for the operating environment are shown in the table below.

No.	Operating Conditions
1	Ambient temperature 0~40°C
2	Relative humidity 35~90%
3	Avoid direct sunlight
4	Avoid exposure to water, cutting oil and other liquids
5	Avoid exposure to corrosive or combustible gas
6	Minimal dust
7	Do not subject to vibrations or shock greater than 0.5G
8	Avoid strong electromagnetic waves, ultraviolet rays and radiation

2. Installation

DS
Arm Type

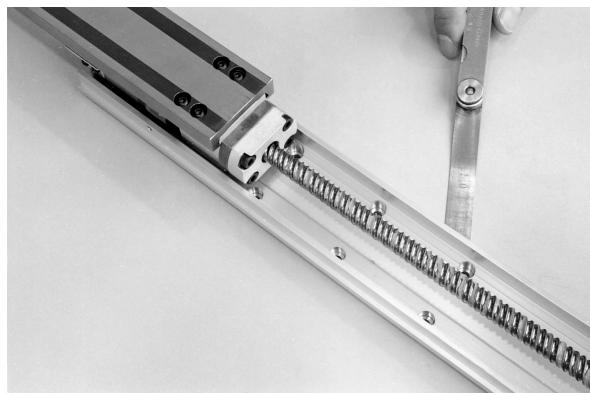
2.1 Installing the Actuator

Mount the actuator to a machined surface or one of comparable precision.

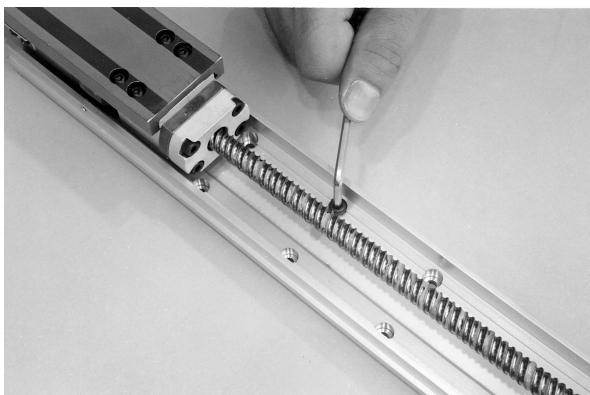


This actuator has a built-in brake. Connect the controller to the unit, then release the brake with the brake switch. After releasing the brake, pull the slider to the stroke end. Turn off the controller power before proceeding to the next step.

Remove the four mounting screws from the screw cover. (The cover can be removed using a 1.5mm hexagonal wrench).



Rest the actuator on the mounting surface and check to see that a 0.1mm thickness gauge cannot be inserted at the four mounting holes.



Affix the actuator using the mounting holes in the base. If the bolts go into a steel surface, then use hexagon sockets with the length shown in (1) and if the surface is a light metal, use the length in (2).

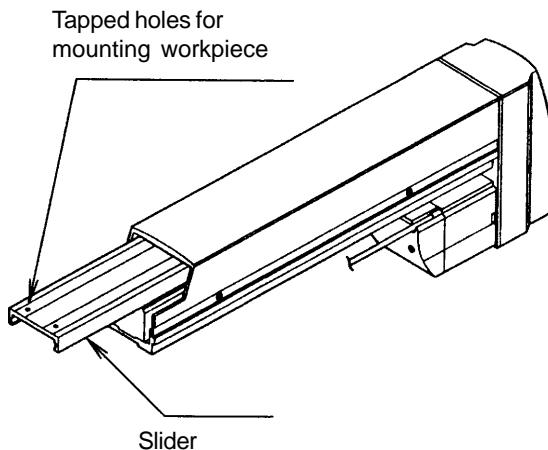
After mounting the actuator, reattach the screw cover.

Actuator	(1)	(2)
DS-A6	M5x40	M5x15
DS-A5	M4X8	M4X12
DS-A4	M3X8	M3X12

2. Installation

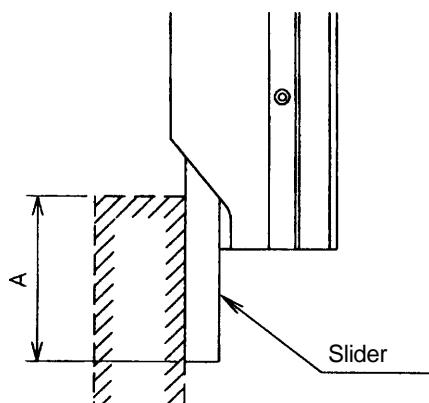
DS
Arm Type

2.2 Attaching the Workpiece



Use the four tapped holes at the top of the slider to attach the workpiece.

There are 4 M4 screws for attaching the workpiece to the slider. To ensure the slider does not become deformed when the workpiece is attached, check to make sure the surface where the workpiece rests is flat. A deformity in the slider causes stiff movement and shortens the life of the actuator.



Do not exceed the load indicated in the specification tables at Part 4. Please note in particular the slider moment, allowable overhang length and the load weight.

Keep the overhang at the upper portion of the workpiece to the measurements below to prevent interference between the screw cover and workpiece.

DS-A6 Type	A=70mm
DS-A5 Type	A=65mm
DS-A4 Type	A=53mm

2. Installation

DS
Arm Type

2.3 Wiring Cable

The actuator cable is resistant to bending fatigue but it is not robot cable so avoid housing the cable in movable wire duct with a small radius. In an application where the cable cannot be properly anchored, try to place the cable so that it sags only under its own weight or use self-standing type cable hose as large radial wire duct to limit the load on the cable.

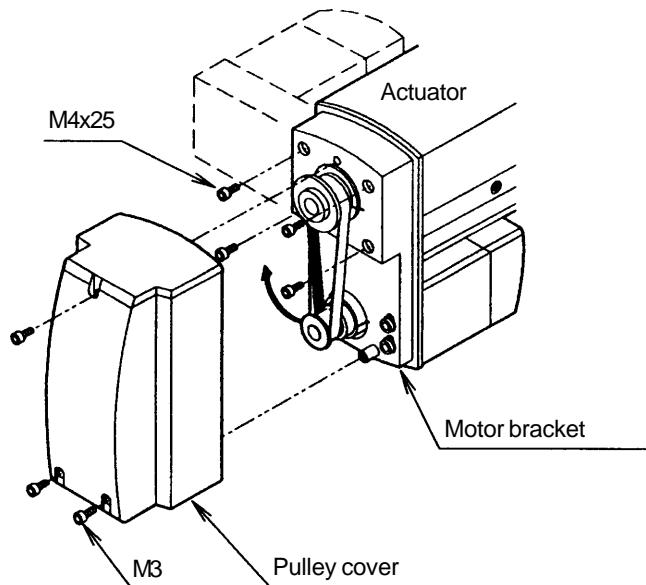
2.4 Adjusting Home Position

After installing the actuator, perform the homing operation to confirm home. Home direction can be changed with the parameters. If you allow a large offset amount, the moving range is limited by that amount. If you specify an offset amount greater than 1mm, you will have to reset the software limit and reduce the stroke by that amount.

Note: To change the home offset amount requires the optional PC software.

2.5 Changing Motor Position

You can change the position of the motor for greater flexibility when installing the actuator.



1. Remove the pulley cover.
2. Remove the four bolts (M4 x 25) used to mount the motor bracket.
3. While pushing the motor bracket lightly against the actuator, rotate it and set the position.
4. Reattach the motor bracket with M4 x 25 bolts.
5. Reattach the pulley cover.

Changing the motor position will affect the home position so always make sure to readjust home. (For a ball screw lead of 6mm, home will move 1.5mm for every 90° change).

3. Maintenance

DS
Arm Type

3.1 Maintenance Schedule

Perform maintenance work according to the schedule below.

	Visual Inspection	Internal Check	Lubrication
Start of operation	<input type="radio"/>		
After 1 month of operation	<input type="radio"/>		
After 6 months of operation	<input type="radio"/>	<input type="radio"/>	
After 1 year of operation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Semiannually thereafter	<input type="radio"/>		
Annually thereafter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Note 1: The above schedule assumes running time is 8 hours per day. When running time is high such as continuous day and night operation, shorten the maintenance intervals as required.

Note 2: The end cover supports the ball screw so please do not remove it. Do not remove the encoder cover as this contains precision equipment

3.2 Cleaning the Exterior

1. Wipe off dirt with a soft cloth.
2. Do not use strong compressed air on the actuator as this may force dust into the crevices.
3. Do not use petroleum-based solvents on plastic parts or painted surfaces.
4. If the unit is badly soiled, apply a neutral detergent or alcohol to a soft cloth and wipe lightly.

3.3 Inspecting the Interior

(1) Removing the cover



Turn the power OFF. Using a 1.5mm hexagonal wrench, remove the cover as shown in the picture and visually inspect the interior.

(2) Visual check of the interior

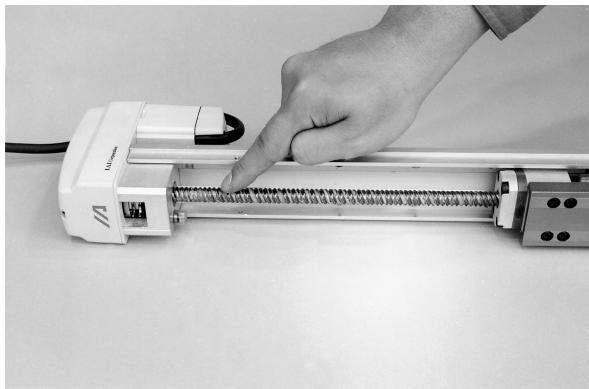
Make a visual check of the interior to see if there is any dust or foreign matter in the unit and check the lubrication. Even if the grease you see around the parts is brown, the lubrication is fine as long as the travelling surfaces appear shiny.

3. Maintenance

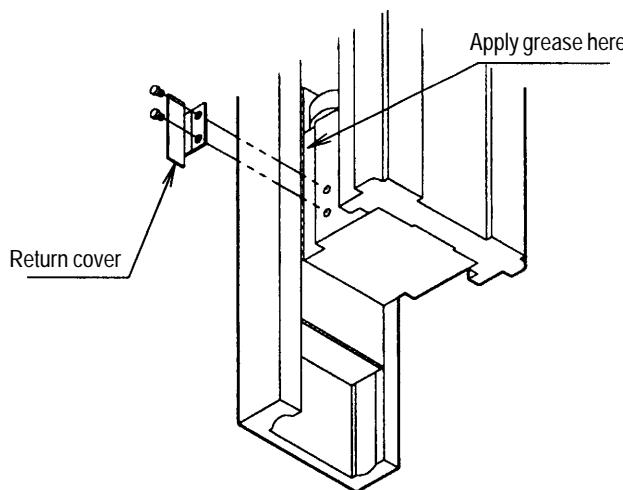
3.4 Lubrication

When the grease contains dust, becomes dull in color or begins to wear away through extended use, lubricate the actuator using the procedure below.

(1) How to lubricate



To lubricate the ball screw, apply grease to the screw with your finger then spread it out by moving the slider back and forth.



To lubricate the slider, remove the return cover attached to the guide block and apply grease directly on the bearing.

(2) What grease to use

IAI uses lithium grease No. 2. There are other brands of grease commercially available for the ball screw and slider. These are acceptable as long as they are a lithium-type grease.

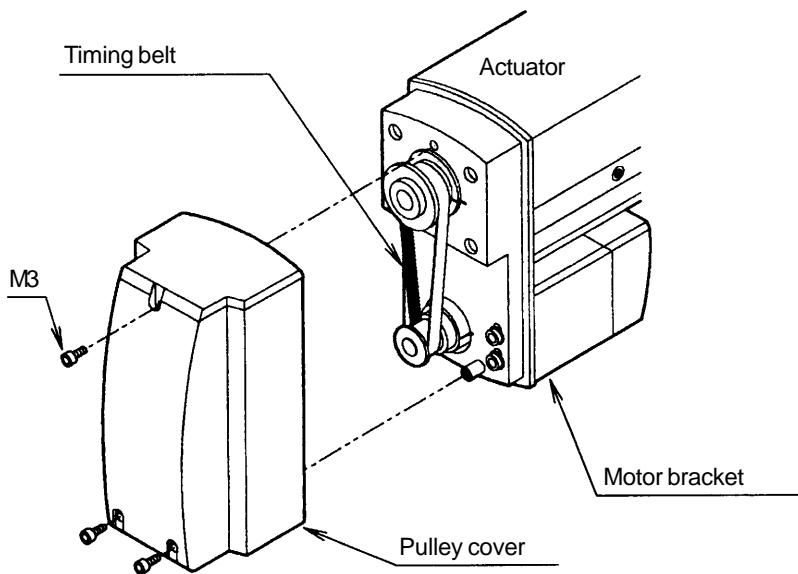
Note: *Never use a fluorine-based grease. Mixing this with a lithium grease produces a chemical reaction which damages the actuator.*

3. Maintenance

DS
Arm Type

3.5 Inspecting and Replacing the Timing Belt

(1) Removing the belt cover



Remove the pulley cover as shown at left and inspect the timing belt.

(2) Inspecting the timing belt

The durability of the timing belt is largely dependent on the operating conditions. It is difficult to give an absolute rule regarding when to replace the timing belt but generally the belt has a lifetime of so many millions of rotations. The more practical approach is to replace the belt if any of the following conditions occur.

- The belt end or belt teeth have worn away.
- There are cracks in or other damage to the belt or teeth.
- The belt breaks.

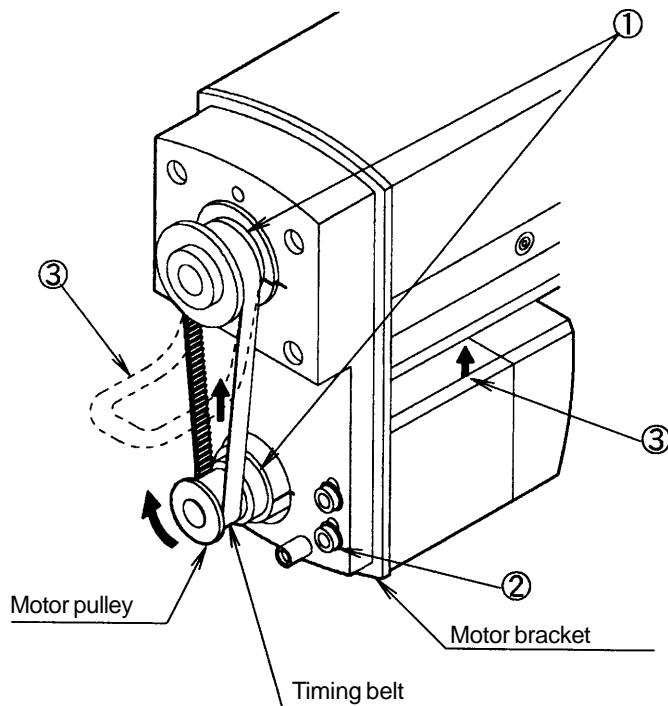
If you need to replace the belt, please contact IAI.

3. Maintenance

DS
Arm Type

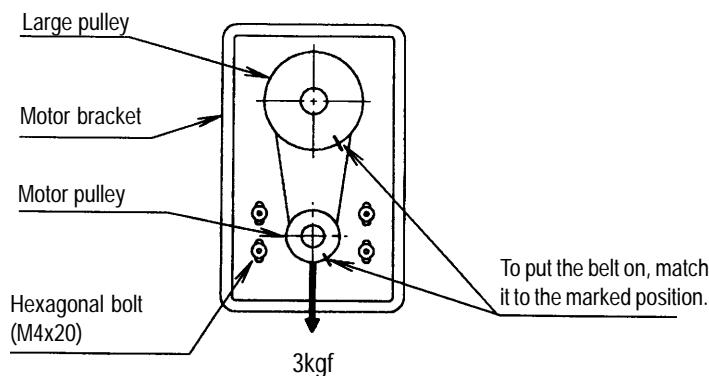
(3) Replacing the timing belt

Follow the procedure below to replace the timing belt.



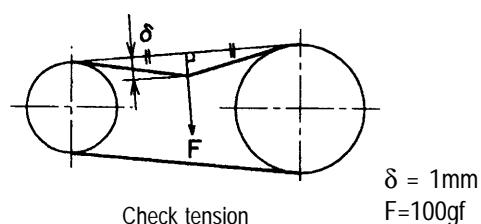
- ① Mark the pulley and motor bracket so that you do not change home position.
- ② Loosen the four bolts.
- ③ Put the new belt on while pushing the motor up.
- ④ After the new belt is in place, do the same procedure in reverse to reassemble.

(4) Adjusting the tension of the timing belt



After you change the timing belt, it is necessary to readjust the tension. As shown in the upper diagram at left, push the motor pulley up, then adjust the tension and set it.

Use the method shown in the left lower diagram to check whether the tension of the timing belt is suitable.

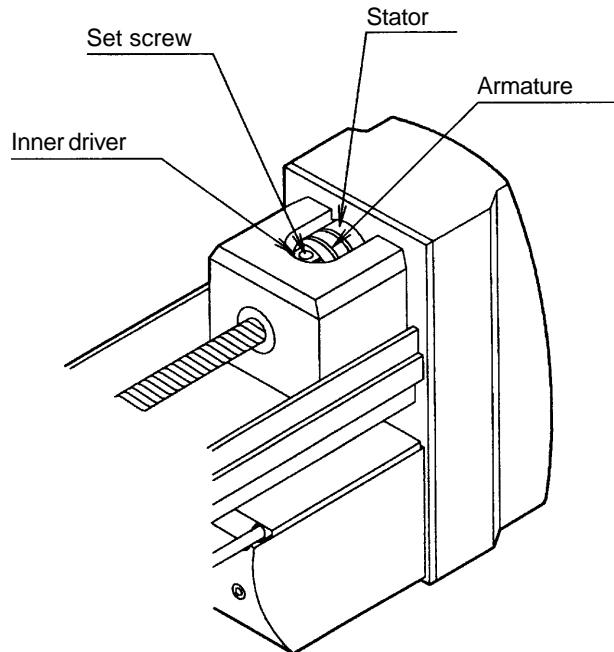


3. Maintenance

DS
Arm Type

3.6 Inspecting and Adjusting the Brake

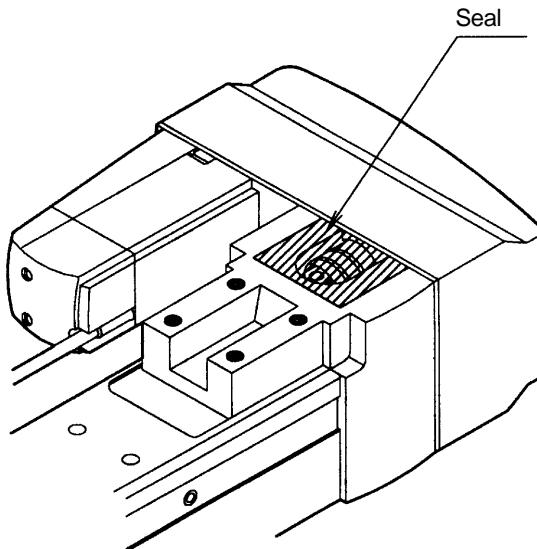
(1) Brake inspection



① Remove the screw cover to inspect the brake.

② Visually check the condition of the brake.

DS5 TYPE (DS-A5)



① Peel off the seal to inspect the brake.

② Visually check the condition of the brake.

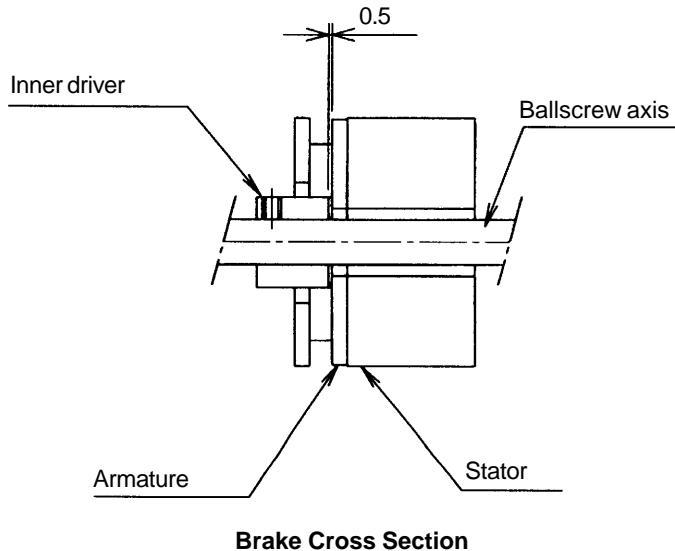
Note: When the motor is folded backwards (S type), you must change the direction to the right or the left.

DS4 TYPE (DS-A4)

3. Maintenance

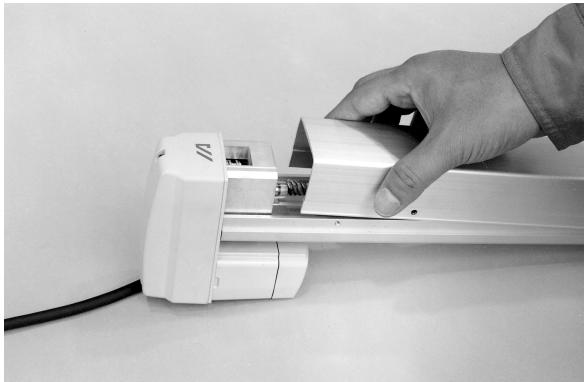
(2) Adjusting the brake gap

Normally, the inner driver requires no maintenance but if adjustments are necessary, use the following procedure.



- ① We recommend the actuator be placed on a horizontal surface when adjusting the brake gap. If you are doing the adjustment with the actuator in a vertical position, first move the slider to the stroke end.
- ② Release the brake and loosen the two set screws.
- ③ Set the inner driver about 0.5mm from where it would hit up against the armature.

(3) Attaching the cover



Follow the procedure used to remove the cover in reverse order and reattach the screw cover and pulley cover.



After you finish the inspection, replace the cover as it was at the start.

1. Specifications for the SlideType

DS

1.1 High Speed Type DS-SA6H

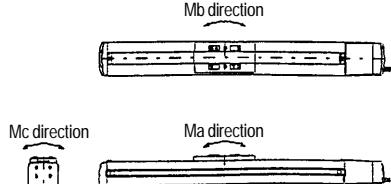
Specifications	Model	DS-SA6H	50	100	150	200	250	300	350	400	450	500	550	600
	Stroke	mm	50	100	150	200	250	300	350	400	450	500	550	600
	Rated Output	W						30						
	Rated Speed	mm/sec					800				760	640	540	
	Rated Thrust	N(kgf)						24.2(2.4)						
	Repeatability	mm						±0.05						
	Unit Weight	kg	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5
	Motor													
	Encoder													
Structure of Main Component														
Application Limit														

1: At a speed of 10mm/sec for 5 seconds.

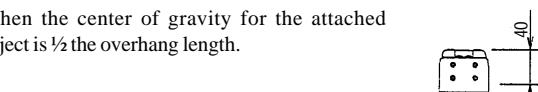
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.

3: At an acceleration of 0.3G and a speed of 800mm/sec.

4: Direction of load moment is:



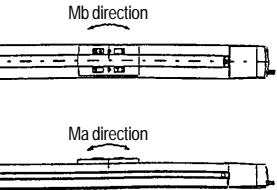
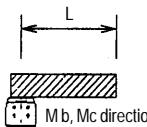
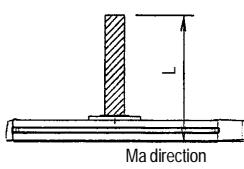
5: When the center of gravity for the attached object is ½ the overhang length.



1. Specifications for the SlideType

DS

1.2 Medium Speed DS-SA6M

Specifications	Model	DS-SA6M	50	100	150	200	250	300	350	400	450	500	550	600
	Stroke	mm	50	100	150	200	250	300	350	400	450	500	550	600
	Rated Output	W						30						
	Rated Speed	mm/sec					400				380	320	270	
	Rated Thrust	N(kgf)						48.4(4.9)						
	Repeatability	mm							±0.02					
	Unit Weight	kg	1.3	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5
Structure of Main Component	Motor													
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V												
	Ballscrew	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less												
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track												
	Motor/Ballscrew Connection													
	Base	Integrated motor axis and ballscrew axis												
	Slider	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated												
	Side Cover	Special steel alloy												
	Dust Shield	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated												
	Motor Housing	Stainless steel												
	Encoder Cover, Front Cover, Slide Cover	Aluminum die-cast Baked finish												
	Cable	Polyacetal plastic												
	Grease	11-conductor composite cable 5m (standard length)												
Application Limit		Ballscrew: Lithium type grease												
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent												
	Model	DS-SA6M	50	100	150	200	250	300	350	400	450	500	550	600
	Maximum Thrust (1)	N(kgf)								145(14.7)				
	Payload (2, 3)	kgw								Horizontal: 12kg	Vertical: 3kg			
	Moment (2, 4)	N·m (kgf·m)								5000km life expectancy				
	Overhang Load Length L (5)	mm								Ma: 8.9(0.9)	Mb: 12.7(1.3)	Mc: 18.6(1.9)		
<p>1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.3G and a speed of 400mm/sec. 4: Direction of load moment is:</p>														
<p>5: When the center of gravity for the attached object is $\frac{1}{2}$ the overhang length.</p>   														

1. Specifications for the SlideType

DS

1.3 Low Speed High Thrust DS-SA6L

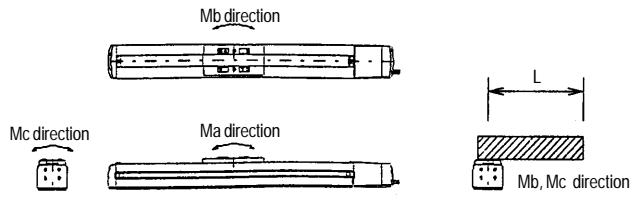
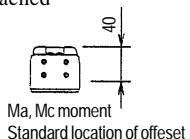
1: At a speed of 10mm/sec for 5 seconds.

2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.

3: At an acceleration of 0.2G and a speed of 200mm/sec.

4: Direction of load moment is:

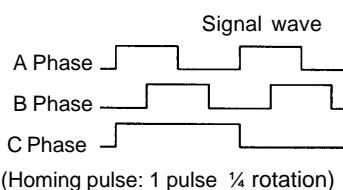
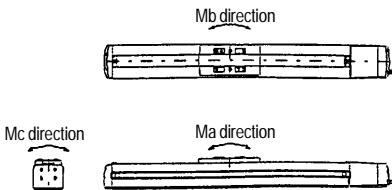
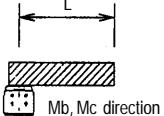
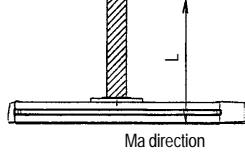
5: When the center of gravity for the attached object is $\frac{1}{2}$ the overhang length.



1. Specifications for the SlideType

DS

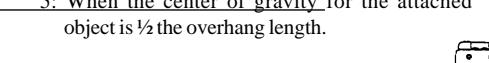
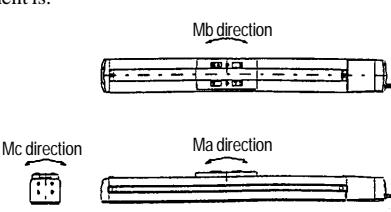
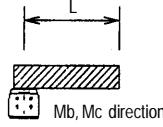
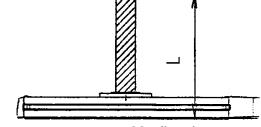
1.4 High Speed DS-SA5H

Specifications	Model	DS-SA5H	50	100	150	200	250	300	350	400	450	500														
	Stroke	mm	50	100	150	200	250	300	350	400	450	500														
	Rated Output	W						20																		
	Rated Speed	mm/sec						800			760															
	Rated Thrust	N(kgf)							16.7(1.7)																	
	Repeatability	mm							±0.05																	
	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1														
	Motor		AC Servo Motor																							
	Encoder		AC motor attached 192P/R A,B,Z Phase Input voltage +5V <div style="text-align: right; margin-top: 10px;">  Signal wave A Phase B Phase C Phase (Homing pulse: 1 pulse 1/4 rotation) </div>																							
	Ballscrew		Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less																							
Structure of Main Component	Guide		Direct recirculating ball bearing: Hardened carbon steel ground track																							
	Motor/Ballscrew Connection		Integrated motor axis and ballscrew axis																							
	Base		Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated																							
	Slider		Special steel alloy																							
	Side Cover		Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated																							
	Dust Shield		Stainless steel																							
	Motor Housing		Aluminum die-cast Baked finish																							
	Encoder Cover, Front Cover, Slide Cover		Polyacetal plastic																							
	Cable		11-conductor composite cable 5m (standard length)																							
	Grease		Ballscrew: Lithium type grease Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent																							
Application Limit	Model	DS-SA5H	50	100	150	200	250	300	350	400	450	500														
	Maximum Thrust (1)	N(kgf)	33.3(3.4)																							
	Payload (2, 3)	kgw	Horizontal: 4kg Vertical: 1kg																							
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy Ma: 4.9(0.5) Mb: 6.8(0.7) Mc: 11.7(1.2) Mc: 7.8(0.8)																							
	Overhang Load Length L (5)	mm	Ma 150 or less Mb, Mc 150 or less																							
1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.3G and a speed of 800mm/sec. 4: Direction of load moment is:																										
5: When the center of gravity for the attached object is 1/2 the overhang length.																										
  																										

1. Specifications for the SlideType

DS

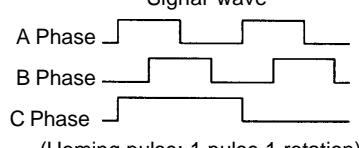
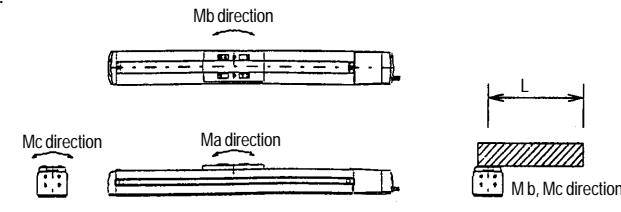
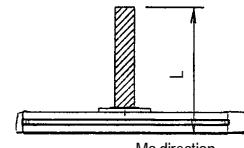
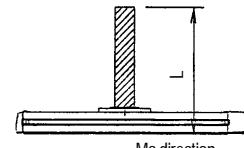
1.5 Medium Speed DS-SA5M

Specifications	Model	DS-SA5M	50	100	150	200	250	300	350	400	450	500		
	Stroke	mm	50	100	150	200	250	300	350	400	450	500		
	Rated Output	W						20						
	Rated Speed	mm/sec						400				380		
	Rated Thrust	N(kgf)						33.3(3.4)						
	Repeatability	mm						±0.02						
Structure of Main Component	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1		
	Motor													
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V												
	Ballscrew	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less												
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track												
	Motor/Ballscrew Connection													
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated												
	Slider													
	Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated												
	Dust Shield													
	Motor Housing	Aluminum die-cast Baked finish												
	Encoder Cover, Front Cover, Slide Cover													
	Cable	11-conductor composite cable 5m (standard length)												
Grease		Ballscrew: Lithium type grease												
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent												
Application Limit	Model	DS-SA5M	50	100	150	200	250	300	350	400	450	500		
	Maximum Thrust (1)	N(kgf)												
	Payload (2, 3)	kgw												
	Moment (2, 4)	N·m (kgf·m)												
	Overhang Load Length L (5)	mm												
	1: At a speed of 10mm/sec for 5 seconds.													
<p>1: At a speed of 10mm/sec for 5 seconds.</p> <p>2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.</p> <p>3: At an acceleration of 0.3G and a speed of 400mm/sec.</p> <p>4: Direction of load moment is:</p>														
<p>5: When the center of gravity for the attached object is ½ the overhang length.</p> 														
  														

1. Specifications for the SlideType

DS

1.6 Low Speed High Thrust DS-SA5L

Specifications	Model	DS-SA5L	50	100	150	200	250	300	350	400	450	500														
	Stroke	mm	50	100	150	200	250	300	350	400	450	500														
	Rated Output	W						20																		
	Rated Speed	mm/sec						200			190															
	Rated Thrust	N(kgf)							65.7(6.7)																	
	Repeatability	mm								±0.02																
	Unit Weight	kg	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1														
Structure of Main Component	Motor		AC Servo Motor																							
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V	Signal wave  (Homing pulse: 1 pulse 1 rotation)																							
	Ballscrew	Ø10mm Lead 3mm Rolled thread C10 Backlash 0.1mm or less																								
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track																								
	Motor/Ballscrew Connection		Integrated motor axis and ballscrew axis																							
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated																								
	Slider		Special steel alloy																							
	Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated																								
	Dust Shield		Stainless steel																							
	Motor Housing		Aluminum die-cast Baked finish																							
	Encoder Cover, Front Cover, Slide Cover		Polyacetal plastic																							
	Cable	11-conductor composite cable 5m (standard length)																								
	Grease	Ballscrew: Lithium type grease																								
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent																								
Application Limit	Model	DS-SA5L	50	100	150	200	250	300	350	400	450	500														
	Maximum Thrust (1)	N(kgf)	131.4(13.7)																							
	Payload (2, 3)	kgw	Horizontal: 8kg Vertical: 4kg																							
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy																							
			Ma: 4.9(0.5) Mb: 6.8(0.7) Mc: 11.7(1.2) Mc:7.8(0.8)																							
	Overhang Load Length L (5)	mm	Ma 150 or less Mb, Mc 150 or less																							
	1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.2G and a speed of 200mm/sec. 4: Direction of load moment is:												5: When the center of gravity for the attached object is ½ the overhang length.													
	 																									

1. Specifications for the SlideType

DS

1.7 High Speed DS-SA4H

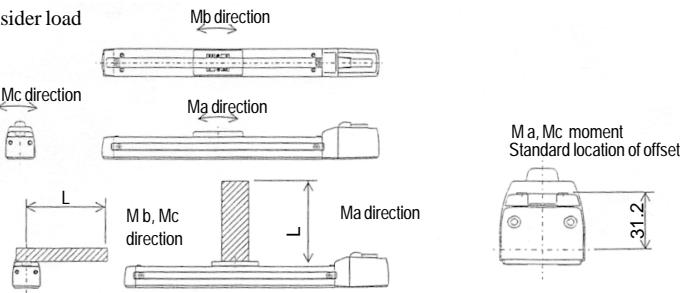
1. Specifications for the SlideType

DS

1.8 Medium Speed DS-SA4M

Specifications	Model	DS-SA4M	50	100	150	200	250	300				
	Stroke	mm	50	100	150	200	250	300				
	Rated Output	W						20				
	Rated Speed	mm/sec						330				
	Rated Thrust	N(kgf)							39.2(2.0)			
	Repeatability	mm							±0.02			
	Unit Weight	kg	0.6	0.7	0.8	0.9	1.0	1.1				
	Motor								AC Servo Motor			
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V							Signal wave			
									A Phase			
Structure of Main Component									B Phase			
									C Phase			
	Ballscrew	Ø8mm Lead 5mm Rolled thread C10 Backlash 0.1mm or less										
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track										
	Motor/Ballscrew Connection								Integrated motor axis and ballscrew axis			
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated										
	Slider								Special steel alloy			
	Side Cover	Eclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated										
Application Limit	Dust Shield								Stainless steel			
	Motor Housing								Aluminum die-cast Baked finish			
	Encoder Cover, Front Cover, Slide Cover								Polyacetal plastic			
	Cable	11-conductor composite cable 5m (standard length)										
	Grease								Ballscrew: Lithium type grease			
									Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent			
	Model	DS-SA4M	50	100	150	200	250	300				
	Maximum Thrust (1)	N(kgf)							78.4(8.0)			
	Payload (2, 3)	kgw							Horizontal: 5kg Vertical: 2.5kg			
	Moment (2, 4)	N·m (kgf·m)							5000km life expectancy			
									Ma: 2.7(0.28) Mb:3.9(0.4) Mc: 6.8(0.7)			
	Overhang Load Length L (5)	mm							Ma 120 or less Mb, Mc 120 or less			
	1: At a speed of 10mm/sec for 5 seconds.											
	2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.											
	3: At an acceleration of 0.3G and a speed of 330mm/sec.											
	4: Direction of load moment is indicated on the right.											
	5: When the center of gravity for the attached object is ½ the overhang length.											

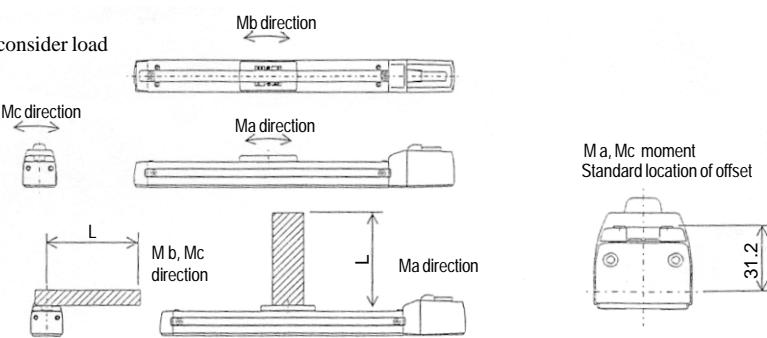
1: At a speed of 10mm/sec for 5 seconds.
 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.
 3: At an acceleration of 0.3G and a speed of 330mm/sec.
 4: Direction of load moment is indicated on the right.
 5: When the center of gravity for the attached object is ½ the overhang length.



1. Specifications for the SlideType

DS

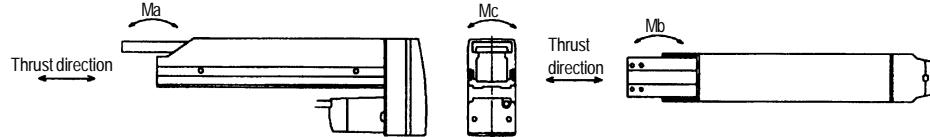
1.9 Low Speed High Thrust DS-SA4L

Specifications	Model	DS-SA4L	50	100	150	200	250	300					
	Stroke	mm	50	100	150	200	250	300					
	Rated Output	W						20					
	Rated Speed	mm/sec					165						
	Rated Thrust	N(kgf)						78.4(8.0)					
	Repeatability	mm						± 0.02					
	Unit Weight	kg	0.6	0.7	0.8	0.9	1.0	1.1					
	Motor								AC Servo Motor				
	Encoder	AC motor attached 192P/R A,B,Z Phase Input voltage +5V							Signal wave				
									A Phase				
Structure of Main Component	Ballscrew	$\varnothing 8$ mm Lead 2.5mm Rolled thread C10 Backlash 0.1mm or less							B Phase				
	Guide	Direct recirculating ball bearing: Hardened carbon steel ground track							C Phase				
	Motor/Ballscrew Connection												
	Base	Exclusive extruded aluminum (A6N01S-T5 equivalent) White alumite treated											
	Slider								Special steel alloy				
	Side Cover	Exclusive extruded aluminum (A6063S-T5 equivalent) White alumite treated											
	Dust Shield								Stainless steel				
	Motor Housing								Aluminum die-cast Baked finish				
	Encoder Cover, Front Cover, Slide Cover								Polyacetal plastic				
	Cable	11-conductor composite cable 5m (standard length)											
Application Limit	Grease								Ballscrew: Lithium type grease				
									Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent				
	Model	DS-SA4L	50	100	150	200	250	300					
	Maximum Thrust (1)	N(kgf)							156.8(16.0)				
	Payload (2, 3)	kgw							Horizontal: 5kg Vertical: 4.5kg				
Overhang Load Length L (5)	Moment (2, 4)	N·m (kgf·m)							5000km life expectancy				
									Ma: 2.7(0.28) Mb: 3.9(0.4) Mc: 6.8(0.7)				
	Overhang Load Length L (5)	mm							Ma 120 or less Mb, Mc 120 or less				
1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.2G and a speed of 165mm/sec. 4: Direction of load moment is indicated on the right. 5: When the center of gravity for the attached object is $\frac{1}{2}$ the overhang length.													
													

2. Specifications for the ArmType

DS

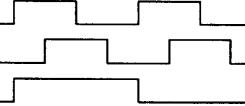
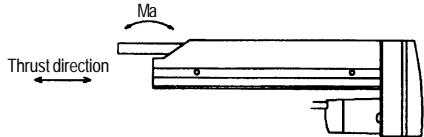
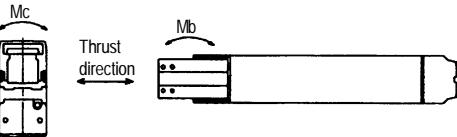
2.1 Medium Speed DS-A6M

Specifications	Model	DS-A6M	50	100	150	200						
	Stroke	mm	50	100	150	200						
	Rated Output	W		30								
	Rated Speed	mm/sec		400								
	Rated Thrust	N(kgf)		48.4(4.9)								
	Repeatability	mm		±0.02								
	Unit Weight	kg	3.0	3.3	3.6	3.9						
Structure of Main Components	Motor	AC Servo Motor										
	Encoder	AC motor attached										
		A-B-Z phase	Voltage output	Signal wave								
		Input voltage	+5V	A Phase								
	Brake			B Phase								
				Z Phase								
				(Homing pulse: 1 pulse ½ rotation)								
		Specifications	Dry, single head, on when deenergized, electromagnetic brake									
	Ballscrew	Model	MCNB1.5-03									
		Holding torque N(kgf)	73.5(7.5)	Single brake torque N·m(kgf·cm)	14.7 (1.5)							
		Mounting position	Ballscrew axis									
		Rated voltage	DC24V									
	Guide	Ø10mm Lead 12mm Rolled thread C10 Backlash 0.1mm or less										
	Motor/Ballscrew Connection	Integrated with base, DS dedicated										
	Slider	Timing belt Reduction ratio ½										
	Base	Hardened alloyed steel										
	Side Cover	Extruded aluminum (A6N01S-T5) White alumite treated										
	Motor Housing	Extruded aluminum (A6063S-T5) White alumite treated										
	Encoder Cover, Pulley Cover	Aluminum die-cast Baked finish										
	Cable	Polyacetal plastic										
	Grease	11-conductor composite cable 5m (standard length)										
		Ballscrew: Lithium type grease										
Application Limit	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent											
	Maximum Thrust (1)	N(kgf)	5000km life expectancy									
	Payload (2, 3)	kgw	Ma:8.1(0.8) Mb: 10.0(1.0) Mc:6.5(0.6)									
	Moment (2, 4)	N·m (kgf·m)	Vertical: 3kg									
			5: When the center of gravity for the attached object is ½ the overhang length.									
1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.2G and a speed of 400mm/sec. 4: Direction of load moment is:												
												

2. Specifications for the ArmType

DS

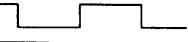
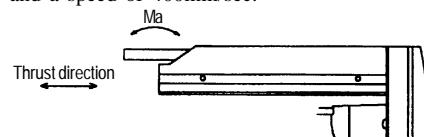
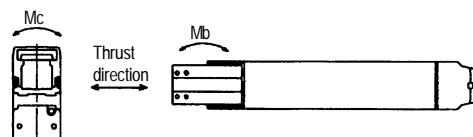
2.2 Low Speed High Thrust DS-A6L

Specifications	Model	DS-A6L	50	100	150	200			
	Stroke		50	100	150	200			
	Rated Output	W		30					
	Rated Speed	mm/sec		200					
	Rated Thrust	N(kgf)		96.8(9.8)					
	Repeatability	mm		± 0.02					
	Unit Weight	kg	3.0	3.3	3.6	3.9			
	Motor	AC Servo Motor							
	Encoder	AC motor attached A·B·Z phase Input voltage	Voltage output +5V	Signal wave A Phase B Phase Z Phase	 (Homing pulse: 1 pulse 1/2 rotation)				
	Brake	Specifications	Dry, single head, on when deenergized, electromagnetic brake						
Structure of Main Components	Brake	Model	MCNB1. 5-03						
	Brake	Holding torque N(kgf)	147.0 (15.0)	Single brake torque N·m(kgf·cm)	14.7 (1.5)				
	Ballscrew	Mounting position	Ballscrew axis						
	Ballscrew	Rated voltage	DC24V						
	Guide	Ø10mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less							
	Motor/Ballscrew Connection	Integrated with base, DS dedicated							
	Slider	Timing belt Reduction ratio 1/2							
	Base	Hardened alloyed steel							
	Side Cover	Extruded aluminum (A6N01S-T5) White alumite treated							
	Motor Housing	Extruded aluminum (A6063S-T5) White alumite treated							
	Encoder Cover, Pulley Cover	Aluminum die-cast Baked finish							
	Cable	Polyacetal plastic							
	Grease	11-conductor composite cable 5m (standard length)							
	Grease	Ballscrew: Lithium type grease							
	Grease	Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent							
Application Limit	Maximum Thrust (1)	N(kgf)	290(29.5)						
	Payload (2, 3)	kgw	Vertical: 6kg						
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy						
			Ma:8.1(0.8) Mb: 10.0(1.0) Mc:6.5(0.6)						
1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.2G and a speed of 200mm/sec. 4: Direction of load moment is:									
  5: When the center of gravity for the attached object is 1/2 the overhang length.									

2. Specifications for the ArmType

DS

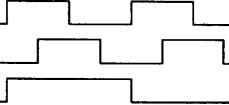
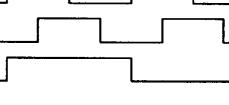
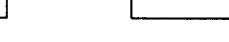
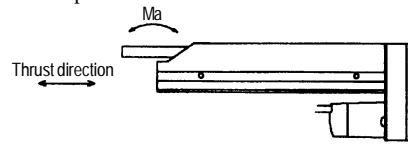
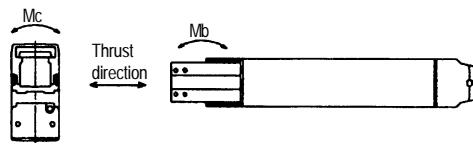
2.3 Medium Speed DS-A5M

Specifications	Model	DS-A5M	50	100	150	200		
	Stroke	mm	50	100	150	200		
	Rated Output	W		20				
	Rated Speed	mm/sec		400				
	Rated Thrust	N(kgf)			33.3(3.4)			
	Repeatability	mm			±0.02			
	Unit Weight	kg	2.2	2.4	2.6	2.8		
Structure of Main Components	Motor	AC Servo Motor						
	Encoder	AC motor attached						
		A·B·Z phase	Voltage output		Signal wave			
		Input voltage	+5V		A Phase			
					B Phase			
					Z Phase			
	(Homing pulse: 1 pulse ½ rotation)							
	Brake	Specifications	Dry, single head, on when deenergized, electromagnetic brake					
		Model	MB33					
		Holding torque N(kgf)	51.0(5.2)	Single brake torque N·m(kgf·cm)	0.098(1.0)			
		Mounting position	Ballscrew axis					
		Rated voltage	DC24V					
	Ballscrew	Ø10mm	Lead 12mm	Rolled thread C10	Backlash 0.1mm or less			
	Guide	Integrated with base, DS dedicated						
	Motor/Ballscrew Connection	Timing belt Reduction ratio ½						
	Slider	Hardened alloyed steel						
	Base	Extruded aluminum (A6N01S-T5) White alumite treated						
	Side Cover	Extruded aluminum (A6063S-T5) White alumite treated						
	Motor Housing	Aluminum die-cast Baked finish						
	Encoder Cover, Pulley Cover	Polyacetal plastic						
	Cable	11-conductor composite cable 5m (standard length)						
	Grease	Ballscrew: Lithium type grease						
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent						
Application Limit	Maximum Thrust (1)	N(kgf)	65.7(6.7)					
	Payload (2, 3)	kgw	Vertical: 2kg					
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy					
			Ma:4.5(0.46)	Mb: 5.4(0.55)	Mc:4.1(0.42)			
1: At a speed of 10mm/sec for 5 seconds. 2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame. 3: At an acceleration of 0.2G and a speed of 400mm/sec. 4: Direction of load moment is:								
  5: When the center of gravity for the attached object is ½ the overhang length.								

2. Specifications for the Arm Type

DS

2.4 Low Speed High Thrust DS-A5L

Specifications	Model	DS-A5L	50	100	150	200											
	Stroke	mm	50	100	150	200											
	Rated Output	W		20													
	Rated Speed	mm/sec		200													
	Rated Thrust	N(kgf)		65.7 (6.7)													
	Repeatability	mm		± 0.02													
	Unit Weight	kg	2.2	2.4	2.6	2.8											
	Motor	AC Servo Motor															
	Encoder	AC motor attached A·B·Z phase Input voltage	Voltage output +5V	Signal wave A Phase													
				B Phase													
Structure of Main Components		Z Phase															
		(Homing pulse: 1 pulse $\frac{1}{2}$ rotation)															
	Brake	Specifications	Dry, single head, on when deenergized, electromagnetic brake														
		Model	MB33														
		Holding torque N(kgf)	103.0(10.5)	Single brake torque N·m(kgf·cm)	0.098(1.0)												
		Mounting position	Ballscrew axis														
		Rated voltage	DC24V														
	Ballscrew	$\varnothing 10$ mm Lead 6mm Rolled thread C10 Backlash 0.1mm or less															
	Guide	Integrated with base, DS dedicated															
	Motor/Ballscrew Connection	Timing belt Reduction ratio $\frac{1}{2}$															
	Slider	Hardened alloyed steel															
	Base	Extruded aluminum (A6N01S-T5) White alumite treated															
	Side Cover	Extruded aluminum (A6063S-T5) White alumite treated															
	Motor Housing	Aluminum die-cast Baked finish															
	Encoder Cover, Pulley Cover	Polyacetal plastic															
	Cable	11-conductor composite cable 5m (standard length)															
	Grease	Ballscrew: Lithium type grease															
		Guide: Shell Albania Grease No. 2, Mobil Mobilux No. 2 or equivalent															
Application Limit	Maximum Thrust (1)	N(kgf)	131.4(13.4)														
	Payload (2, 3)	kgw	Vertical: 4kg														
	Moment (2, 4)	N·m (kgf·m)	5000km life expectancy														
			Ma: 4.5(0.46) Mb: 5.4(0.55) Mc: 4.1(0.42)														
	1: At a speed of 10mm/sec for 5 seconds.																
2: Even load distribution on the slider. (When designing work, consider load moment). Fix base securely to a flat, strong frame.																	
3: At an acceleration of 0.2G and a speed of 200mm/sec.																	
4: Direction of load moment is:																	
 																	

1. Trouble Shooting

Discrepancies	Cause		Compliance
"RES" (reset appears on the LED display when power is supplied.	1	I/O connector is not connected.	Connect the I/O connector.
	2	I/O connector +24V is not supplied to pin 1A and I/O connector OV is not supplied to pin 17.	Supply power against the I/O connector.
	3	Pin 1A (+24V) of I/O connector and pin 17B (OV) were reversed.	Check the I/O wiring.
	4	100V(200V) was input to the I/O connector.	Check the I/O wiring.
	5	Output ports load exceeds 100mA.	Check the load ratio.
	6	Total load of output ports exceeds 140mA.	Check the load ratio.
	7	N side of the controller main power was not connected properly.	Check the main power wires.
	8	From the above causes 3, 4, 5, 6, and 7, the circuit component protection (CCP) has been damaged.	Return for repair.
"ERG" (emergency stop) appears on the LED display once power is supplied.	1	Emergency stop activated.	Release emergency stop.
	2	The wiring is disconnected at the emergency stop terminal board of the controller.	Connect emergency stop wiring.
	3	Emergency stop box of the PC cable is not connected to the PC cable.	Connect emergency stop box.
	4	IN, OUT of the PC cable are connected in reverse.	Check connection.
	5	PC cable was not connected properly.	Connect properly.
	6	Main power +24V and OV were connected in reverse.	Swap connection.
	7	Non-assigned cable was connected to the RS232C connector.	Connect assigned cable.
	8	100V (200V) was input to the controller.	Check wiring.
	9	Protective source (L1) of the emergency stop circuit has shorted from above causes 7, 8 and 9.	Return for repair.
The output port does not output is not in correct state.	1	Output port was short circuited to 24V due to no load.	Check for wiring.
	2	Load of output port exceeds 100mA for each pin.	Check load ratio.
	3	Total load of output port exceeds 400mA.	Check load ratio.
	4	Output port was connected to 100V(200V).	Check wiring.
	5	Protective resistance of the output has broken down due to above causes 2, 3 and 4.	Return for repair.
	6	Transistor array (TD62084) has broken down due to above causes 2, 3 and 4.	Return for repair.

Discrepancies	Cause		Compliance
Once output port is turned ON, all ports have a output signal (simultaneously).	1	Output port is wired incorrectly.	Check wiring.
	2	Due to output port short circuit, excessive load from excessive voltage, the fly wheel diode of the transistor array (TD62084) has gone into breakdown.	Return for repair.
Leakage current of output port is significant. The input LED display is lightly blinking.	1	+24V was not input to pin 1A of I/O connector.	Check wiring.
	2	Damage has occurred to the circuit component protection (CCP).	Return for repair.
Stops suddenly during movement without releasing an alarm. Upon cycling power, LED display disappears and resets. Communication with the controller is not possible (timeout error) and display shows error.	1	Static electricity or high level noise have occurred in the C.P.U.	Check earth ground. Check noise, static electricity levels with compliance levels.
	2	Breakdown has occurred in CMOS and RAM, as well as in the surrounding circuitry.	Return for repair.
Program position data and parameters are lost.	1	Static electricity and high level noise in the main CPU, CMOS, and RAM have occurred.	Check earth. Noise, static electricity compliance.
	2	Breakdown has occurred in the main CPU and surrounding circuitry as well as CMOS and RAM.	Return for repair.
	3	Breakdown has occurred in the backup battery and surrounding circuitry.	Return for repair.
Timeout error occurs without communicating with the controller.	1	Poorly connected teaching pendant and PC, or breakdown have occurred.	Check connection.
	2	Possible bad wire in the teaching pendant and PC cable.	Return for repair.
	3	Breakdown has occurred in the controller's main CPU and surrounding circuitry.	Return for repair.
Controller is not receiving power.	1	Main power is not connected to the controller.	Check wiring.
	2	100V (200V) was input to the controller's main power.	Return for repair.
	3	Breakdown has occurred on the power board of the controller.	Return for repair.
I/O circuit is chattering.	1	Incorrect contact of the I/O wiring has occurred.	Check wiring.
	2	Intermittent pulse on the I/O board has occurred.	Stabilize the power supply
	3	Noise and static electricity have occurred on the I/O board.	Noise, static electricity compliance

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